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Naval Architects and Marine Engineers.

Col. E. A. Stevens' paper upon "Practical Methods of Conducting Trials of Vessels," was as follows:

Speed trials outside the navy are in this country only too often caried out under conditions that render the results "painfully inaccurate." These conditions are due to many causes, but chiefly to a lack of appreciation of the value of the data to be obtained, to an exaggerated idea of the cost, and sometimes to carelessness.

I have been present at the trial of vessels in which speed was one of the important features, where the course was betwen lighthouses the distance between which was obtained by scaling from a chart, and where no correction was allowed for any change in the course steered while passing these marks.

In another case I have known of a vessel failing to complete the first run, on a course marked as above, where the distance was similarly ascertained. The time of the slowing down of the engine was taken approximately. the distance still to be run was estimated or, to be exact, guessed, and the speed carefully computed on this basis.

In still another case, steam was bottled up for a high-speed run which was made at about 11.4 miles against the tide; steam was then again bottled, which process took about half an hour; the run was then made with the tide at about 18.7 miles, the mean revolutions being 157 and 168 respectively, in both cases decreasing toward end of run. The tide was at its height and probably varied considerably between the runs. The mean of the speed, however, was taken as the true speed, without correction for variation in tidal speed or revolutions.

Such observations as these, while they may give an approximation of the speed, cannot be regarded as satisfactory. Nevertheless I have known one of the above trials to have been used as the basis for some rather refined estimates of speed and power.

It is usually hard to get either owner or builder to regard the trial trip seriously. The best that can be hoped for in most cases is that a few hours may be allowed for the purpose and, in case of any failure to get the desired observations, it is not usually to be expected that the trial can be repeated.

This means a limited number of runs. Under such conditions the trials should be planned with care, run as systematically as possible and every provision made to get results.

The apparatus needed is neither very expensive nor intricate. It should, however, be reliable. The observations after all can give knowledge on but three points:—

1. The time on the course.
2. The revolutions—ether the total on the course or the revolutions per minute.
3. The mean effective pressure in cylinders.

The record of time and revolutions should be taken simultaneously. The device illustrated in the paper by the late Naval Constructor Woodward (see Transactions of 1905), furnished an excellent means to insure simultaneous records and a very accurate registering mechanism.

On Plate 1 is shown diagrammatically a device I have used for this purpose with much success. It consists of a contact arranged to work from the indicator-gear lever which opens and closes a circuit at each revolution; current is furnished by a battery of six dry cells. A magnet is energized by the current and moves a plunger against a spring which, on the opening of the circuit, forces the plunger back. This motion is recorded on a counter. I have used the registering apparatus of a gas meter as the cheapest device for this purpose. The counter is started by a switch at the beginning of each run and stopped at the end; a watch held by the same observer can be started and stopped at the same time. The result is, of course, not as accurate as the device suggested by Woodward but is much less expensive. There is no reason why it should not be combined with Woodward's starting device at a reasonable cost. Stopwatches used on trials should be carefully rated. It is wonderful how inaccurate some of the cheaper makes will be found.

Indicators are often incorrectly rigged. Their springs should be tested. I met one case in which the spring in the low pressure cylinder was marked as 20 pounds but on testing was found to be very accurately 16.

A tachometer set in plain view of the man at the throttle will enable him to maintain a constant speed much more satisfactorily than without its aid. A record of the readings of this instrument begun say two minutes before entering on course, and during the run, will establish the facts that speed conditions were constant and will eliminate erroneous data. It will also furnish a check on the revolutions per minute at the time that indicator cards are taken.

To get a satisfactory result the trial must be carefully planned. The force necessary to take the observations must be provided. The work of each

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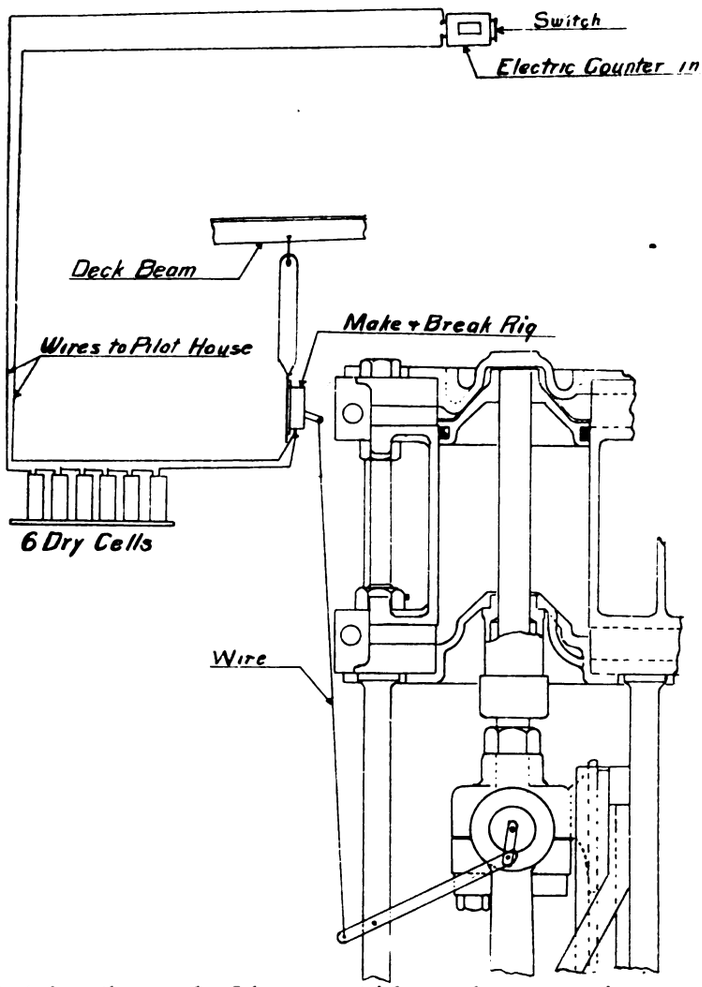
man should be definitely prescribed and no one should have more put on him than he can attend to without hurry. Whatever apparatus is to be used should be carefully overhauled, put in thorough order and, if possible, tested on the vessel. I knew one trial to go wrong because the indicator piping was of different size from the fittings on the instruments, which difference was not discovered until the vessel had left the yard. In this case the parties in charge would not order a return to correct the mistake.



A very important part of the planning is the determination of the speeds at which runs shall be made. The settlement of this depends on the system on which the results will be plotted. To properly determine a curve of speed on revolutions per minute, five spots should be had at different speeds. These spots can be obtained by the second means of three runs at each speed, or more closely by the means of second means of four runs at each speed. This involves 20 runs, which is usually more than can be had.

The system in use in the navy is based on a set of runs at evenly progressive speeds with four runs at the highest speeds. The runs with and against the tide are plotted separately, and curves of speed with and against the tide are drawn. To give reliable results runs must be made at evenly progressive speeds and at nearly equal time-intervals. Failure to comply with these conditions may induce considerable error.

To illustrate this the curves on Plate 2 have been drawn.

The curve of revolutions per minute is an actual one and the revolutions per minute for each run are from the corresponding trial. From this curve the true speed is known. The tide curve is assumed. Runs in Set 2 are assumed at even intervals and in Set 1 at uneven intervals. The tidal corrections are taken from curve, apparent speeds deduced and curves thereof plotted. On taking the mean curve it is found that Set 2 will practically reproduce the revolutions per minute curve. Set 1, however, gives a decidedly erroneous curve.

I have so often had runs spoiled by other vessels or by some failure in the apparatus or in the machinery that I must confess to a decided prejudice against the navy system under such conditions as I have met. We cannot get a staff of Annapolis graduates and a Rockland course nor will owners stand for the increase in cost that Uncle Sam pays for his trial trips. The navy system requires 14 runs.

To meet ordinary conditions the tidal formula explained in the Transactions of 1901 seems generally preferable. It may be used in the form originally given or in the following form:—

Tidal force in knots per hour $= \frac{RaSw - RwSa}{Ra + Rw}$;

Where R = average revolutions per minute.

S = apparent time on course.

Suffix a refers to runs against and w with the tide. The course is assumed one knot in length.

This formula is based on the quality of advance per revolution. Fairly accurate results can be had with ten runs and good results with 12. Runs can be made in any order of speed provided enough pairs be made to derive tide curve. The trial illustration is not specially adapted for its use on account of there being no pairs of runs at the same speed, but applying it to such runs as are nearly alike in speed gives the spots shown on plate. The error is less than shown by having runs at unequal intervals and using the navy method of plotting. The calculations are shown in full in the annexed table.

TABLE OF ASSUMED TRIAL DATA.

—Run—		R. P. M.	Speed.	Set I. Hour at middle of run.	Set I. Tide corr.	Set I. App. speed	Set II. Hour at middle of run.	Set II. Tide corr.	Set II. App. speed.
1	N	116.20	17.03	10.03	—0.78	16.25	11.00	—1.53	15.50
2	S	215.70	16.97	10.15	+0.95	17.92	11.15	+1.70	18.67
3	N	115.00	16.91	10.30	—1.16	15.75	11.30	—1.85	15.06
4	S	113.90	16.78	11.15	+1.70	18.48	11.45	+1.96	18.72
5	N	112.33	16.60	11.30	—1.85	14.75	12.00	—2.03	14.57
6	S	108.93	16.18	11.45	+1.96	18.14	12.15	+2.10	18.28
7	N	107.77	16.02	12.00	—2.03	13.99	12.30	—2.12	13.90
8	S	99.03	14.91	12.15	+2.10	17.01	12.45	+2.10	17.01
9	N	93.84	14.20	12.30	—2.12	12.08	1.00	—2.04	12.16
10	S	91.04	13.81	1.15	+1.95	15.76	1.15	+1.95	15.76
11	N	85.02	13.01	1.30	—1.85	11.16	1.30	—1.85	11.16
12	S	83.09	12.71	2.15	+1.42	14.13	1.45	+1.72	14.43
13	N	77.40	11.92	2.30	—1.25	10.67	2.00	—1.58	10.34
14	S	74.45	11.50	2.45	+1.06	12.56	2.15	+1.42	12.92

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It will be seen that the use of this formula is more laborious than plotting the runs separately, but the amount of labor is not excessive.

Whatever system is adopted it is well to remember that our observations are accurate only within a certain limit. That limit may by careful observation and expensive apparatus be reduced, but it cannot be eliminated.

The error involved where ordinary apparatus is carefully and intelligently used is not material from the designer's standpoint.

It is useless work to chase results of ordinary trials to the first place of decimals in power and to the third place in speed.

DISCUSSION.

Prof. Walter S. Leland: Those of us who have had to do with progressive speed trials realize the truth of what Col. Stevens has just said, but in one particular we differ with him. In our opinion it is possible to get a satisfactory progressive trial with 10 runs regardless of whether these runs occur at equal intervals of time or not.

At the Massachusetts Institute of Technology we have had some experience in such work and make it a practice to plot two curves of speed, one with the tide and one against, but we plot them on hours and minutes as abscissa. For instance, if we cross the starting line at 10 o'clock and the finishing line at 10:10, the mean speed of the run, say 6 knots, would be plotted at the ordinate 10:05. If it takes 10 minutes to swing onto the course again and 8 minutes to make the return run, then the mean speed of say, 4.6 knots, would be plotted on the ordinate 10:24. Points are thus plotted for five runs each way and curves found through each set of points. The difference between these two curves is a pretty close estimate of tidal influences at any time. Even though we were fortunate enough to get all of our runs at regular intervals we should still plot the results as outlined her for we do not like to consider that the tidal influence is constant from, let us say, 10 o'clock to 10:25, the hypothetical time referred to.

To correct the actual speed over the course we would subtract the tidal effect at 10:05 from the mean observed speed on that run and add the tidal effect at 10:24 to the mean observed speed on that run.

If the revolutions are the same on both runs the 10 corrected speeds will be substantially the same unless some error has been made in observation or computation. Suppose one run should happen to fail. It is unfortunate, of course, but really it does not throw out the pair of runs as must otherwise be done. The two speed curves will be similar and can readily be found with the loss of one point in each. We have had the tide change during a test without vitiating the results.

If it should happen that the revolutions on each of a pair of runs were slightly different one could readily be corrected from data determined from an approximate speed on revolution curve plotted in the ordinary way.

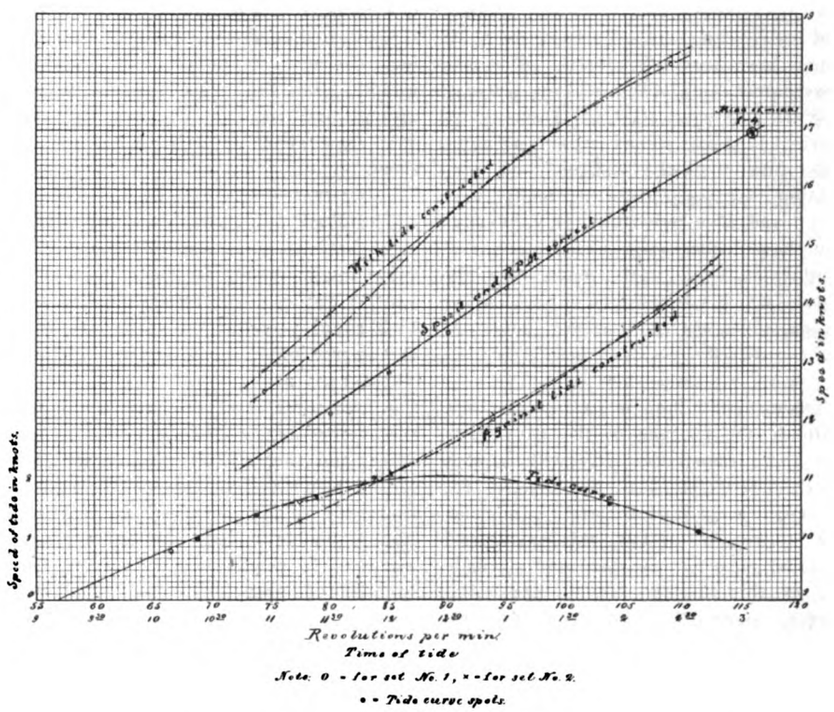
As previously stated, we make five runs each way. The lowest at half speed, the rest at about ¾, ⅞, 15/16 and full speed. The curves are usually pretty straight excepting near the top, hence the necessity of 11 points at this place. At the lower end of the curve we have, of course, zero speed at zero revolution, which really makes 6 points on the final speed on revolution curve.

As to keeping the revolutions constant, we find starting at the highest speed, it is not a difficult matter to hold the boiler pressure constant, and let the throttle alone, to keep the revolutions satisfactory. If you start at the lowest speed it is not always easy to get speed enough to keep up the revolutions, but by starting at the higher power we never have had any difficulty.

The President: Before Mr. Taylor begins his remarks, the chair thinks it is desirable to state that it seems unfortunate that any paper should go on record and leave any impression that the methods reprobated here are at all common or customary in the United States.

We unfortunately have some reputation for carelessness in compiling our engineering data abroad already, and it is by no means desirable that this impression should be enhanced by such a record. It has never been my happy experience to get a vessel accepted under such conditions, and for the information of the society, I shall ask Mr. Taylor if he is not all ready to make such a statement, to make a full and complete statement of the methods prevailing in the navy for the trials of vessels, and the chair also desires to state that one of the greatest practical encouragements which could be provided in the interest of careful trials would be the establishment by the government of convenient courses for such trials, measured mile courses convenient for trial trips, and of suitable draught of water for the different vessels to be tried. Some nations conveniently have shallow draught measured miles for the testing of torpedo boat destroyers, and deep draught measured miles, for large vessels, and we should have all these conveniences.

D. W. Taylor: I think we have quite a supply of measured mile courses.



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There is a course at Rockland, that is a deep course of the government, and the Fore River works, in conjunction, have a very good course in Provincetown, which is one of the very best courses as regards the marks. There is a course at the Delaware breakwater, which is in the deepest water possible. It is not a very great course, as regards the current, but is highly satisfactory. The Chesapeake Bay course is in the best location possible in Chesapeake Bay. I do not think we have any shallow draught courses, which are favorable to high speed, and presumably we will not have until after the new destroyer is brought out.

There are two very good courses on the west coast, one in Puget Sound, and one near Santa Barbara, both of which have been officially laid off by the government and both in deep water.

With reference to Col. Stevens' remarks, I think all of us must agree with him that the difficulty of conducting accurate trials is really very great, and it is only fully realized after you have endeavored to lay out and conduct an actual trial. Apart from the things which always go wrong at the wrong time, there are many points to be considered.

STOP WATCHES NOT ACCURATE.

Taking up the question of stop watches, the practice in the navy is to use three observers, each with a stop watch. That has been the practice for a long time. Unfortunately Constructor Stocker is not here this morning. I wish he were here, as he could speak to us on this subject, as he has taken part in nearly all of the naval trials recently, and he is familiar with all the details which I am not. It was the practice in the case of the three observers referred to, if the time on the course differed more than a small fraction of a second, if one observer was 4/10 of a second out, and the other two observers were 1/10 of a second, the man who was out 4/10 of a second, was thrown out, and there were a number of cases which occured which threw suspicion on the accuracy of the stop watches, and it is now the practice, in addition to stop watches, to have a carefully rated chronograph, as a check on the stop watches. It was found with the stop watches, though they might be tested and run the day before with practically no error. yet in view of the fact that sometimes these trials are conducted in cold weather, and the stop watch got chilled, or for some cause, it would go wrong at the critical moment. If you wish to get stop watch time, the only accurate way is to have more than one, and probably three. Two out of three will generally give fairly accurate results. You could hardly expect on these trials to have a chronograph.

I think the system to which Col. Stevens refers has been materially modified in the last year or two, as the result of experience. Some of the difficulties and objections to it, which he says had cropped out—the question of the interference with the trials—has seldom come up on the Rockland coast. I think I was present at the only case where a run was lost in several years through a vessel getting in the way. That was the case of a photographer who was anxious to get a photograph and the boat on which he was stationed got immediately in front of the vessel being tested, and the run was repeated, but the run was interrupted about the middle, and the vessel simply turned around and repeated the run, and the spot came about as well as the rest of them.

ADVANTAGES OF ROCKLAND COURSE.

The Rockland course has the advantage that the maximum tidal current is very small, about three-quarters of a knot. The present naval practice for high speed vessels is to make five runs at the maximum speed, instead of four. These runs are grouped in two groups, the first three, and the last three, and the second mean of each group is taken, and then the average of the two second means. That is virtually equivalent to giving the runs No. 2, 3 and No. 4, double weight, and runs No. 1 and No. 5, single weight, but the advantage of grouping them in two groups is in case there has been a bad run from some cause, it does not vitiate the whole series and it shows on the face of it.

Then, having established the high spot, the series of runs is made without varying the revolutions in groups of three, the attempt is made to run three times with as little change as possible in the revolutions and the second mean of each step of three is taken for the spot upon the curve. That has the advantage, if the tidal current varied uniformly with the time, that would eliminate absolutely the effect of the tidal current. It is, in practice, about as accurate to take three runs as to take four, and I think it is simply more accurate than to take two runs working against the tide.

The real difficulty in a matter of this kind is the fact that the tidal curve is not a smooth curve. It is the practice of the board which conducts trals of naval vessels, to carefully plot, in connection with the other data, the tidal curve during each drive, and I saw the other day an assemblage of these tidal curves, and there was not a single curve which approached the correctional signs with great accuracy. The trouble on the Rockland course is apparently that the tidal current does not vary uniformly, but by fits and starts. This is confirmed from tidal observatons of vessels working on the course. No one can go over such a series of curves without being hampered by the action of the current, by the velocity of the current. It appears to vary greatly, and there is no way of eliminating the erratic variations. If you have a course like Rockland, where the tidal current is small, these variations, although very erratic, are small and do not vitiate the result. If you have a course where the tidal current is strong, the only safety is to make the important runs during the height of the tide, when the tide is slowing the variations are least, during the first quarter ter when increasing and last quarter when falling off, the variations are apt to be more erratic then during the half of the tide when at its strength.

NECESSITY OF MANY RUNS.

As to the runs referred to by Col. Stevens, unfortunately the runs in the case of all high speed vessels that had to be increased to five runs at top speed, and three runs of low speed, and it is almost necessary to work up to about 20 runs. That cannot be done in the half of the tide in practice, but if the more important runs are taken at the time when the effect of the tidal current is least, which is the attempt in practice, I think the results are quite satisfactory.

Col. Stevens touches on the question of the indicator. I think that the speed, if possible, can be obtained with very much more accuracy than the power, even if the watches are a little out. Careful observers of speed, of revolutions, certainly in naval practice can be obtained with substantial accuracy. I have seen speed curves of sister vessels, where the boats were practically identical at top and low speeds, and varied materially at intermediate speeds. There is no explanation of that fact, except that the indicators did not give correct power. You can understand that the curve might coincide with high speed, and differ at all other speeds, or the curve might coincide at low speed, and differ at all other speeds, but they cannot coincide at two speeds and remain identical throughout, unless it is the fault of the indicator. If any one will examine carefully the table showing the power developed in, the various cylinders, not average total power, but power developed in various cyl-

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inders, he will find that with the same set in the throttle, and same revolutions, the mean effective pressure on a given cylinder on successive runs varies in the most remarkable manner, without any explanation, the steam pressure the same, throttle opening remaining the same, the revolutions the same, and every factor which may affect the steam pressure may be the same, but yet the average steam pressure on successive runs appears to vary. I think the main factor of uncertainty in the trials in the navy is not speed in revolutions, but in connection with the power.

The president: Mr. Post, may I ask you to say something on the subject of trial trips.

A TRIAL TO THE SHIP BUILDER.

Walter A. Post: I do not think I can add very much to what has been already said. The importance of the subject, of course, appeals to every ship builder. Trial trips are a trial to the ship builder, and as Col. Stevens has indicated in the paper, the government does not pay for all the trial trips of a government ship, nor pay completely for any trial of a government ship. The government simply prepares the course and furnishes the observers, and the ship builder does the rest.

Mr. Taylor's description of the way the government trials are now conducted agrees exactly with my own information on the subject. I might say I have seen trials run, where one of the runs was a failure, and yet a very good curve gotten. There was no objection raised to it on the part of the builders or the trial board.

As to the Rockland course, my information agrees with Mr. Taylor's pretty closely as to the effect of the current, only my idea of it was that the maximum was about 9/10 of a knot, but the direction of the current varies several times during a trial, and is very arbitrary in its variation. I do not know that there is anything more that I can add to the subject.

GOVERNMENT MILE COURSES.

William J. Baxter: In addition to the different courses mentioned by Mr. Taylor, I can add that there are two government mile courses in the North river, which have been used very frequently for small boats, principally launches, and the exact location of these courses I will append in the printed discussion.

W. Carlile Wallace: I am inclined to agree with Mr. Taylor in his statement that the liability to error in the diagrams, in getting the power is greater than the liability to error in the speed. At the same time I think if proper care is taken, and proper arrangements made beforehand, that the power can be accurately obtained.

For a number of years I took charge of the diagram staff in the Denny Co., and as you all know they were the first to introduce the progressive trials, because it was necessary to be careful before the trial that the indicator springs were all in proper order, that the indicators themselves worked properly, and then he got down to the arrangement so that we had a man at every cylinder, whether a twin screw or otherwise, we always put a man at every cylinder. At the time of going on the mile, or just before going on the mile, the telegraph rang down so as to give the "span by" and then at the moment of going on the mile, the telegraph again rang, and they at once started to take diagrams, at the same time taking the counters on the engine, and during the run, unless it was a very high speed boat, we generally managed to get three or four cards from each cylinder, examining the cards carefully to show the pressure under water, or anything that would cause a bad diagram, and in that way we got very fairly good results. I think it is necessary, if you want to get the results with every possible care, to have a really efficient man at your indicators, because the liability of water, and one thing and another, is very great. In regard to plotting the curve that did not come inside of my work at all. That was the work of the regular staff.

THE ROCKLAND COURSE.

The President: The chair apologizes for taking an undue part in this discussion, but cannot lose this opportunity to complain about the Rockland course. It has been my duty to very carefully study this subject, and while the Rockland course is a magnificent one, so far as concerns the area and depth of water available for the maneuvering and the running of the vessel, the marks are exceedingly objectionable, and are the most frequent cause of the loss of the run. The landmarks in the mile have only a land background, and after the sun has passed the meridian they become almost invisible. In the winter, with a snow background, the difficulty is not decreased over that of occasional houses and barns and pine wood which occur in the summer time. It seems to me it is the plain duty of the government to make these marks large enough and distinct enough to avoid the missing of the marks by five separate observers.

Joseph H. Linnard: I think we all recognize that some of the marks on these courses are not what they should be, but contrary to the generally received opinion, the government has sometimes financial difficulties in obtaining any funds, or the funds which are available, for the purpose of making these necessary improvements.

I cannot, of course, speak for the navy department authoritatively, but I have not the slightest doubt that any ship builder or other person who is interested in any particular course, any trial course, those mentioned in the discussion, used by the navy department can obtain full data with charts and all other available information, so they can run their own trial trips, by addressing the navy department on the subject.

There is nothing confidential, as far as I am aware, about the courses, the laying out of the course and the exact length between the different beacons, which of course, as a rule are not exactly one mile, and I have no doubt that all this information can readily be obtained on application, for any legitimate purpose.

IMPROVING GOVERNMENT COURSES.

D. W. Taylor: I agree in the reference to the Rockland course, and the remarks concerning its being susceptible to improvement, although I do not believe there is a case where five observers missed a mark. I have an impression that the government made an attempt several years ago to improve this course, to improve the marks on the course, and the difficulty was to some extent financial. They did not make an arrangement for a black mark on the north end. On the south end the land is comparatively low, and it would be possible to bring the marks up high enough to show against the sky line, which is the desired condition. At the north end there is a small mountain in the way, and it would be probably very difficult to erect a signal to show above the sky line at that point. I think it would be necessary to buy land to get a satisfactory mark high enough above the surrounding country to be perfectly distinct. I believe if it had not been a case of holdup, the difficulty in making the necessary arrangement of marks on that course, would have been overcome. If Mr. Woodruff was here he could tell you all the details of that matter.

The President: Mr. Taylor unfortunately doubts the statement made from the chair, of an instance where five separate observers lost a mark, and I can only say I have held my breath on the mile—but fortunately speeds are now coming up so that it is not as difficult as it was then—but that trial was in the case of the Rhode Island, which

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was held in the month of December, November or December, and all the government observers and our own observers failed to get the time.

Mr. Taylor: You never knew any other case?

The President: I have known other cases where several observers missed, but not all. Where the government observers failed the trial was ruined.

If there is no further discussion we will call upon Col. Stevens to close the debate.

COL. STEVENS REPLIES.

Col. E. A. Stevens: Answering the various remarks which have been made, I would say as to Prof. Leland's question, that the tidal formula gives the speed of the tide at the middle point, at the middle of the two runs, and that it is assumed that a curve plotted between the tidal speeds thus obtained will give correct values of the mean tide during each run. I have tried it as against the navy system of plotting, and several others. When I refer to the naval curve I refer to the old fashioned one of two separate curves. I have tried the two formulae and the results are practically the same. There is very little difference in the resulting curve of R. P. M. on speed, but with the naval formula, in the case of considerable inequality in time interval, the result may contain considerable error and if they happen to be important speeds, you introduce an element of uncertainty in your speed line curve.

I call attention to the fact that as we get to lower speed we must get to a point at which slip is decreasing with the speed. The plotting of a curve of R. P. M. through zero may introduce considerable errors in the low speed, due the fact that below a certain speed slip will decrease with speed. If the speeds are of value, the error may be of some consequence.

I trust that the chair will pardon any seeming effect of his remarks in throwing doubt on the accuracy of our trials. I have not had much experience on the other side of the water, but such experience as I have had with merchant work convinces me the conditions over there are not much better than ours. They are generally satisfied in their merchant work in getting approximate speed data.

I think probably our national buoyancy of temperament induces us to represent results as we get them as accurate results. If there is any error it is in that, and there is no question at all that nowhere are trials more accurately and carefully conducted than in the United States navy.

AS TO ACCURACY OF STOP WATCHES.

As to the accuracy of stop watches, I found that two watches rated one day and carried in the pocket—each had been hung up and carried in the pocket so as to acquire the temperature of the body—when rated they had the temperature of the atmosphere of the room in which they were hung, but in a short time varied considerably. I have known cases of other accurate watches which varied considerably when carried by different men. A watch which would run at a very constant rate, and well fixed rate in one man's pocket, when changed to another man's pocket changed its rate. That is an unquestioned fact, no doubt about it. That was discovered in a series of observations on watches built by Howard, of Boston, and carried by the pilots of one of the North river ferries. I was in special personal charge of these watches myself, and I discovered that changing a watch from one man to another would almost invariably affect its rate, so that it could be observed at the end of a week. In some cases the variation would amount to something over a second a day. The rating changed from plus to minus to such changes. I do not know whether that fact is generally known, but I feel certain of that fact as to that set of watches, and they were a good set of watches.

INFLUENCE OF TIDAL CURRENTS.

Of course, any one who has had anything to do with tidal currents know that they are very erratic. I do not know whether naval constructors go according to scale in constructing formulae and deriving curves therefrom, but I am informed that some of the formulae will enable a curve to climb a tree. I do not know whether his skill will enable him to plot the variations of tidal currents and express them in a formula. All we can get is an approximation, and that approximation must assume some law, otherwise our tidal formulae will be of no use. No tidal formula will integrate a rational run of tide. Personally, I have no confidence in measurements made from anchored vessels. I conducted two sets of such measurements in the North River, and both of them in considerable tide ways, where the error would be reduced on account of tide which ran considerably over two knots. Measurements simultaneously taken from two sides of a row boat never agree, or if they did agree, it was just enough to make the exception prove the rule. In one case the most accurate measurements I found were those taken with a very firm fish reel. We used one of these on each side of the boat, with a small chip resembling the old fashioned chip log. Curves were made for the difference between the speed shown by the chip, and bottle floats which were released with them. We would allow these to run with the tide, and make a correction for the difference between the speed of the chip and the speed of the float.

D. W. Taylor: I had the same experience.

Col. Stevens: These corrections were, however, quite small. We could not get runs to agree from two sides of row boat, and when I see these tidal measurements taken from large vessels which are surging on their anchors more or less, I must say I have very little faith in them unless checked by some other method.

PROBLEM OF ACCURACY.

I have had the same experience as Constructor Taylor in regard to the accuracy of runs—it is easier to get the runs at higher tide velocity. The tide seems to be then more regular than at any other part of its run. I had precisely a similar experience as to the power at the two high spots, with considerable divergence in between. I do not think we usually appreciate the fact, when we are taking in the indicator cards, that what we are doing, one way or another, is to plot the M. E. P. on the revolutions, and we may not do that correctly, but when we come to the final result it embodies that process of the relation of the revolutions of the engine to the pressure in the cylinders, and that pressure will vary if the rudder is turned, it will vary considerably with the wind. In one set of trials, where I tried the plotting of M. E. P. on revolutions, I found the spots grouped themselves on two groups, with a few intermediate spots. The revolutions had been taken very accurately, and a large number of cards taken both on and off the course. In going back to the spots I found a spot so high that it showed that the M. E. P. were all taken on runs against the wind, variation being considerable, and the M. E. P. referred to the low pressure cylinder, and there was two pounds difference, 10 per cent error.

I agree with Mr. Wallace that after all with proper care we can get very fairly reliable results with indicators. For any one who cannot afford the luxury of a torsion meter, they are about the only method of satisfactory getting power.

I think it is well to criticise the

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marks on the Rockland course. I have been twice on the Rockland course, one time in beautiful weather, and on the other occasion the weather was slightly hazy. On this latter occasion, the second occasion, it was extremely difficult to make out the marks, even with the aid of a very powerful glass. But even with that, the superiority, especially for any high speed vessels, of the Rockland course over any other course I have tried, is very marked. I have always found that the officials at the nearest navy yard will give you all the information you may desire as to courses in that neighborhood.

I do not know that many of our members are aware that there is in the neighborhood of New York four different measured miles. I do not know whether they are all measured by the government or not, but we have two on Long Island Sound and two on the North river. I believe there are two in the Delaware river. I know there is one, and of course there are others in the Chesapeake Bay. Now, all of them generally have portions with shallow water. In the upper Hudson river course the direction of the tide varies considerably. The lower course, just above the Riverside Drive, is much better.

I will say, in general conclusion, that I trust to be able to correct before the transactions are finally printed, several typographical errors which have crept into the paper and one or two errors due to the haste with which I prepared the final draft of the paper.

THE INFLUENCE OF MIDSHIP SECTION UPON THE RESISTANCE OF SHIPS.

D. W. Taylor then read his paper upon "The Influence of Midship-Section Shape Upon the Resistance of Ships."

1. The question of the influence of the shape of the midship section of a vessel upon its resistance is one concerning which the opinions of naval architects differ a good deal. The object of this paper is to lay before the society information throwing some light upon the question, obtained from experiments at the United States model basin during the past year.

It should be pointed out in advance and carefully borne in mind that, though the actual area of the midship section in a given case may have large influence upon resistance, this is a subject not taken up in the present paper, which deals only with the effect of the shape of the area, not the area itself.

2. The question of shape of midship section was investigated by means of five types of lines, all the product of Draftsman-in-Charge W. T. Powell.

Forty models were tried in all, their data being given in Tables I and II.

Table I refers to the 20 models which had a cylindrical or prismatic or longitudinal coefficient (*l*) of 0.56, being thus rather fine-ended models. Table II refers to the 20 models which had a longitudinal coefficient of 0.68, being thus full-ended models. The ratio of beam to draught for all models was 2.923.

TABLE I.

Data of models of 0.56 longitudinal coefficient used for midship-section coefficient experiments.

Mean immersed length of all models, 20.00 ft. Waterline length of all models, 20.512 ft.

Model No.	Displacement of model in fresh water. Pounds.	Midship-section coefficient.	Model —dimensions— Beam, feet.	Draught, feet.*	Displacement length coefficient, salt water.
826	.....	0.70	4.187	1.432	.....
830	.....	0.80	3.916	1.340	.....
834	3,000	0.90	3.692	1.263	159.6
838	.....	1.00	3.503	1.198	.....
842	.....	1.10	3.339	1.143	.....
827	.....	0.70	3.627	1.241	.....
831	.....	0.80	3.393	1.161	.....
835	2,250	0.90	3.199	1.094	119.7
839	.....	1.00	3.035	1.038	.....
843	.....	1.10	2.893	0.990	.....
828	.....	0.70	2.961	1.013	.....
832	.....	0.80	2.769	0.948	.....
836	1,500	0.90	2.611	0.893	79.8
840	.....	1.00	2.477	0.847	.....
844	.....	1.10	2.361	0.808	.....
829	.....	0.70	2.417	0.827	.....
833	.....	0.80	2.261	0.774	.....
837	1,000	0.90	2.132	0.729	53.2
841	.....	1.00	2.022	0.692	.....
845	.....	1.10	1.928	0.660	.....

*All models tested on even keel.

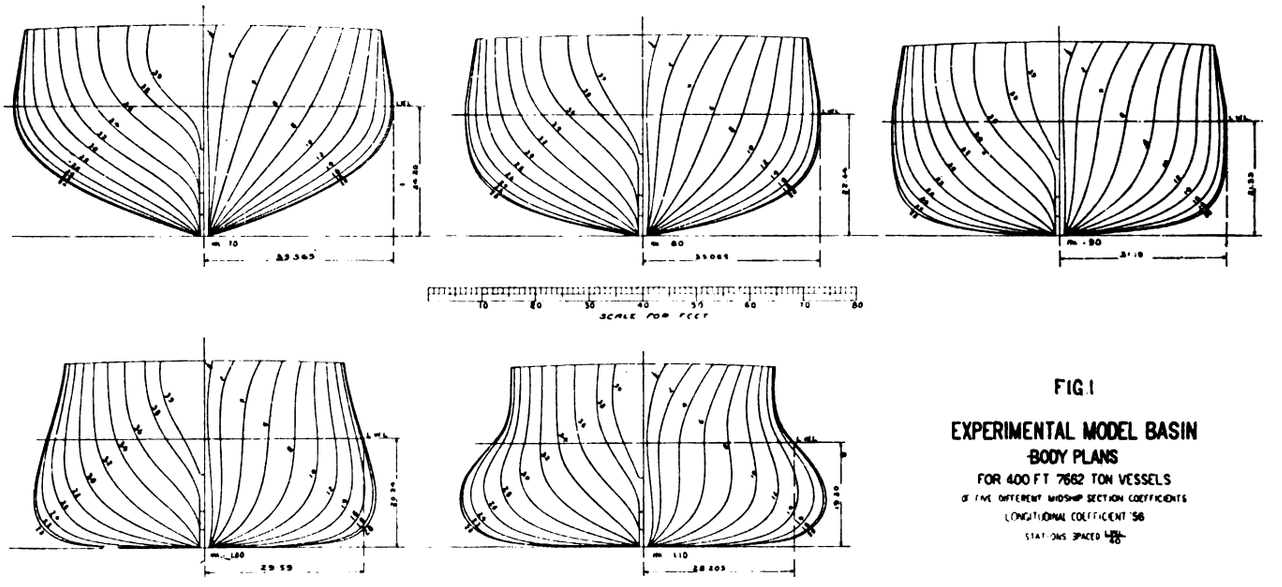

FIG. 1

EXPERIMENTAL MODEL BASIN

BODY PLANS

FOR 400 FT 7662 TON VESSELS

OF FIVE DIFFERENT MIDSHIP SECTION COEFFICIENTS

LONGITUDINAL COEFFICIENT .56

STATIONS SPACED 1/10 L

TABLE II.

Data of models of 0.68 longitudinal coefficient used for midship-section coefficient experiments.

Mean immersed length of all models, 20.00 ft. Waterline length of all models, 20.512 feet.

Model No.	Displacement of model in fresh water. Pounds.	Midship-section coefficient.	Model —dimensions— Beam, feet.	Draught, feet.*	Displacement length coefficient. salt water.
889	.....	0.70	3.283	1.123	.....
893	.....	0.90	3.071	1.051	.....
897	2,250	0.90	2.895	0.991	119.7
901	.....	1.00	2.747	0.940	.....
905	.....	1.10	2.618	0.896	.....
890	.....	0.70	2.681	0.917	.....
894	.....	0.80	2.508	0.858	.....
898	1,500	0.90	2.364	0.809	79.8
902	.....	1.00	2.243	0.767	.....
906	.....	1.10	2.138	0.732	.....
891	.....	0.70	2.188	0.749	.....
895	.....	0.80	2.047	0.701	.....
899	1,000	0.90	1.930	0.660	53.2
903	.....	1.00	1.831	0.626	.....
907	.....	1.10	1.745	0.597	.....
892	.....	0.70	1.548	0.530	.....
896	.....	0.80	1.448	0.495	.....
900	500	0.90	1.365	0.467	26.6
904	.....	1.00	1.295	0.443	.....
908	.....	1.10	1.234	0.423	.....

*All models tested on even keel.

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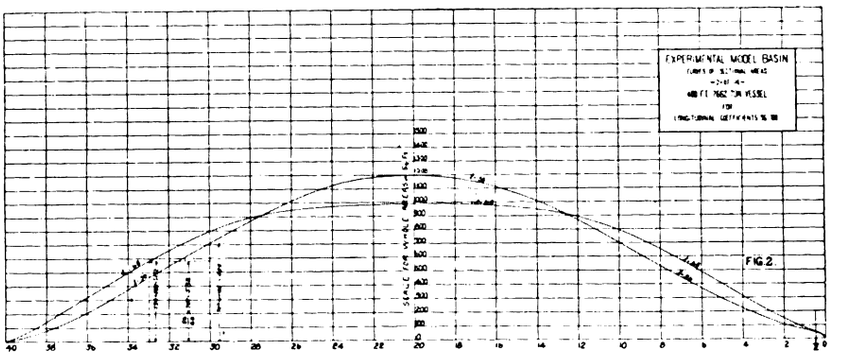


3. It will be observed that the slenderness of these models, if I may apply this expression, is characterized by what I call "Displacement Length Coefficient," or $\frac{D}{\left(\frac{L}{100}\right)^3}$, where D is displacement in salt water in tons and L is length on water-line in feet. This coefficient is also the displacement in tons of a vessel upon the lines of the model and 100 ft. long. It is a convenient coefficient to use when dealing with questions of speed.

4. There were five separate midship-section coefficients (m) used; namely, 0.7, 0.8, 0.9, 1.0 and 1.1. Each coefficient was used with the two longitudinal coefficients and with four displacement length coefficients. Fig. 1 shows the five types of lines for five vessels 400 ft. long and of 7,662 tons displacement, the longitudinal coefficient of each being 0.56.

Change of displacement for fixed longitudinal and midship-section coefficients was obtained by changing both beam and draught the same percentage. The same parent lines were used for each longitudinal coefficient.

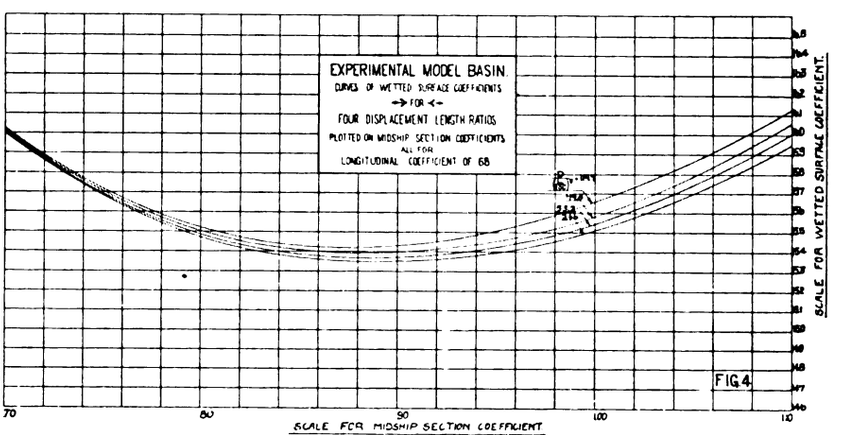
5. The variations in fullness were obtained by shifting the sections fore and aft. Fig. 2 shows the two curves of sectional area used for the longitudinal coefficients (l) 0.56 and 0.68 They both, in this case, refer to a 400-ft. vessel of 7,662 tons displacement.

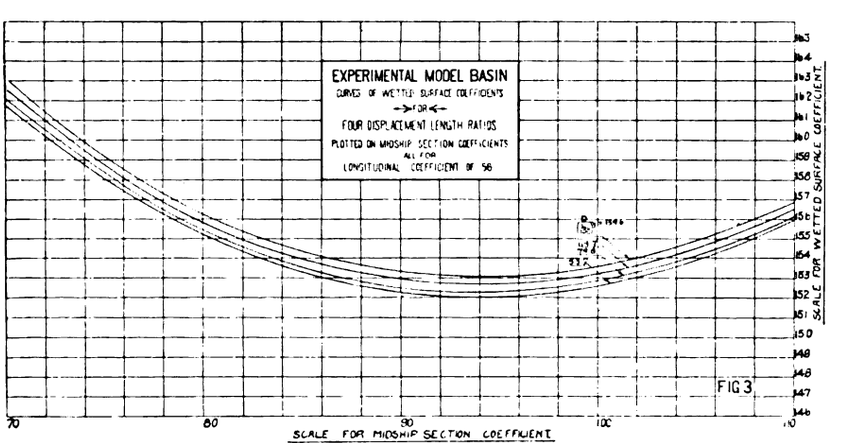
For identical displacements as in Fig. 2, the actual midship-section area for the 0.68 coefficient is less than that for the 0.56 coefficient, but the midship sections themselves are similar. The smaller area corresponding to the 0.68 coefficient was obtained by reduction of dimensions from the larger area required by the 0.56 coefficient. The method of passing from one form to another is indicated in the figure. Thus at station 33 the area required for the 0.68 coefficient vessel is 582 sq. ft. This area is 582 ÷ 987 or 0.590 of the midship area of the 0.68 coefficient vessel, which is 987 sq. ft.

The midship area of the 0.56 coefficient vessel is 1,198 sq. ft.; 0.590 of this is 707 sq. ft., which is found at station 30, hence the section at 33 on the 0.68 ship is the section at 30 on the 0.56 ship reduced in size from 707 sq. ft. to 582 sq. ft., both beam and draught being reduced in the same proportion.

6. Taking up now the relative resistances, these may be considered under two heads; namely, frictional resistance and residuary resistance, the latter being mostly wave making. The frictional resistance is assumed to depend only upon the wetted surface. The wetted surface is very conveniently expressed by a formula in a paper by me to be found in Volume I (1903) of the transactions of the society; namely, $S = C\sqrt{DL}$ where S is the wetted surface in square feet, C is the coefficient, D is the displacement in tons in salt water, and L is the mean immersed length in feet.

Figs. 3 and 4 give curves of wetted surface coefficient deduced from calculations of the 40 models and plotted upon midship-section coefficient in each case. Fig. 3 refers to the longitudinal coefficient of 0.56 and Fig. 4 to the longitudinal coefficient of 0.68. The four curves of each figure refer to separate values of displacement length coefficient as indicated.





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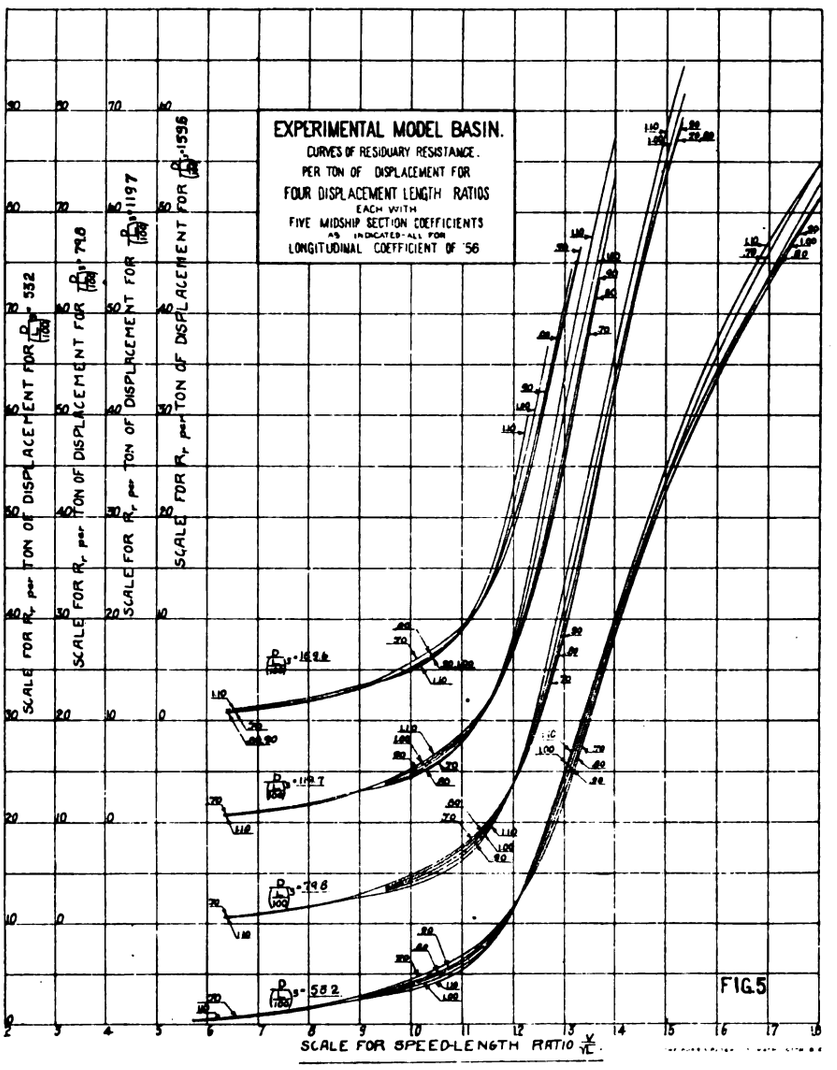
EXPERIMENTAL MODEL BASIN.
CURVES OF RESIDUARY RESISTANCE.
PER TON OF DISPLACEMENT FOR
FOUR DISPLACEMENT LENGTH RATIOS
EACH WITH
FIVE MIDSHIP SECTION COEFFICIENTS
AS INDICATED-ALL FOR
LONGITUDINAL COEFFICIENT OF .56
SCALE FOR R, per TON OF DISPLACEMENT FOR D/(L/100)³ = .532
SCALE FOR R, per TON OF DISPLACEMENT FOR D/(L/100)³ = .718
SCALE FOR R, per TON OF DISPLACEMENT FOR D/(L/100)³ = .1197
SCALE FOR R, per TON OF DISPLACEMENT FOR D/(L/100)³ = .1596
D/(L/100)³ = .1596
D/(L/100)³ = .1197
D/(L/100)³ = .798
D/(L/100)³ = .532
FIG.5
SCALE FOR SPEED-LENGTH RATIO V/√L

It is seen that, broadly speaking, there is in each case a minimum wetted surface which occurs for midship-section coefficient a little above 0.90 in the case of the fine-ended models, and a little below 0.90 in the case of the full-ended models. Very fine midship section and very full midship section both involve an increase of wetted surface, but since, in practice, midship-section coefficients greater than unity are not used, the practical conclusion to be drawn from Figs. 3 and 4 is that for midship-section coefficients between 0.85 and 1.00 there is little variation of wetted surface due to the midship-section coefficient alone.

For very fine midship sections, as 0.7 for example, there is an appreciable increase in wetted surface and a corresponding increase in frictional resistance, although this increase is not serious.

In passing, it may be remarked that a comparison of Figs. 3 and 4 will show that for midship-section coefficient about 0.84 the absolute wetted surfaces are almost identical both for the fine-ended ships and the full-ended ships. Above this coefficient the wetted surfaces are slightly less for the fine-ended ships, and below this coefficient they are slightly less for the full-ended ships.

7. Coming now to the question of residuary resistance, Figs. 5 and 6 give 40 curves of residuary resistance obtained from the 40 models tried. These curves are plotted not on actual speed or in terms of actual resistance, but upon the speed-length ratio $\frac{V}{\sqrt{L}}$ and with resistance expressed in pounds per ton. This means that they are applicable, regardless of size.

It will be seen that, broadly speaking, within the limits of practicable speed, the residuary resistance is less the greater the midship-section coefficient.

For Fig. 6 (longitudinal coefficient 0.68) the residuary resistance is less at all speeds with almost no exception. For the curves of Fig. 5 (longitudinal coefficient 0.56) at speeds below the speed-length ratio of from 1.1 to 1.2 the large midship-section coefficients have the advantage. Above this point in Fig. 5 the results are somewhat confused, but, as a general thing, the finer the midship-section coefficient the less the resistance. It should be borne in mind, however, that these higher speeds are beyond the speeds obtained in practice by vessels of this type. For such high speeds the longitudinal coefficient of 0.56 is too small and, while 0.68 is rather high, it is closer to the best coefficient than 0.56. It will be found, for instance, that at the highest speeds the resistances for the same values of displacement length coefficient are less in Fig. 6 than in Fig. 5.

8. Figs. 3, 4, 5, and 6 deal with separate elements of resistance. As expressing more definitely concrete results, Figs. 7 and 8 show curves of total effective horsepower as estimated from the experiments, Fig. 7 for a large vessel of 0.56 longitudinal coefficient and Fig. 8 for a small vessel of 0.68 longitudinal coefficient. Each figure shows five curves corresponding to the five midship-section coefficients, and it is seen that here, too, the large coefficients have a little the best of it.

9. A natural tendency is to associate fineness with speed and to suppose that a fine midship section is favorable to speed. The results of experiments with the 40 models laid before you in this paper show that, as regards these models, fineness of midship-section is by no means favorable to speed, and furnish a presumption that, for vessels generally of ordinary types, it is not favorable to speed. Of course, it cannot be claimed that the 40 models tried cover the whole possible field. For instance, I hope to have an opportunity to make some experiments on this subject where, instead of varying both beam and draught to obtain variation of midship-section coefficient, draught is varied and beam not changed.

It seems reasonable to conclude, however, that the shape of the midship section has a comparatively minor influence upon the speed, and that the midship-section coefficient may range from 0.85 to 1.0, with very little effect upon speed and may be made as

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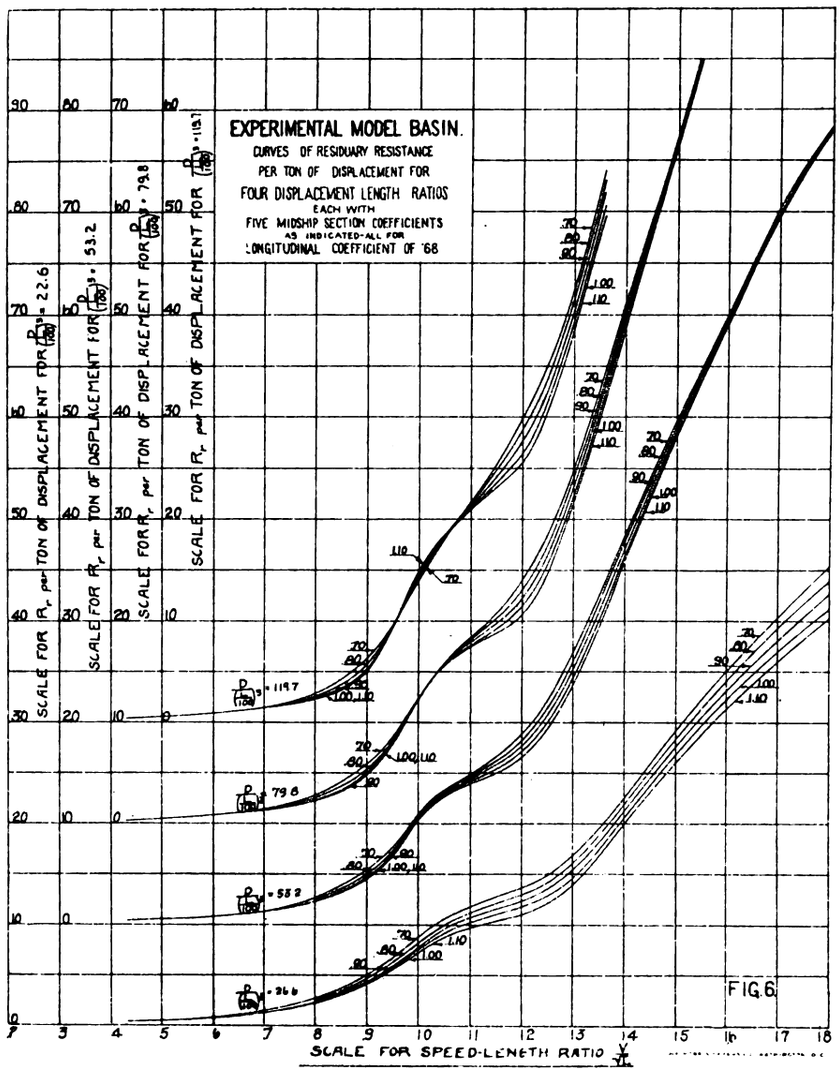
EXPERIMENTAL MODEL BASIN.
CURVES OF RESIDUARY RESISTANCE
PER TON OF DISPLACEMENT FOR
FOUR DISPLACEMENT LENGTH RATIOS
EACH WITH
FIVE MIDSHIP SECTION COEFFICIENTS
AS INDICATED-ALL FOR
LONGITUDINAL COEFFICIENT OF .68
SCALE FOR R per TON OF DISPLACEMENT FOR (D/(.01L)^3 = 22.6)
SCALE FOR R per TON OF DISPLACEMENT FOR (D/(.01L)^3 = 53.2)
SCALE FOR R per TON OF DISPLACEMENT FOR (D/(.01L)^3 = 79.8)
SCALE FOR R per TON OF DISPLACEMENT FOR (D/(.01L)^3 = 119.7)
SCALE FOR SPEED-LENGTH RATIO V/√L

FIG. 6.

low as 0.70 without a material increase in resistance.

10. A reasonable explanation of the results I have laid before you may, I think, be deduced from an inspection of Fig. 1. It is seen that the fine midship sections are associated with the large dimensions.

This is necessarily the case when we separate the question of midship-section coefficient from the question of midship-section area. If area is constant, smaller coefficients must mean larger dimensions. For instance, keeping the area of midship-section constant for the vessels of Fig. 1 and passing from the extreme midship-section coefficient of 1.1 to 0.7, we increase the draught from 19.3 ft. to 24.2 ft. and the beam from 56.41 ft. to 70.73 ft. Increased beam and draught mean increased disturbance of at least a portion of the water through which a ship passes.

11. The results of the special series of experiments on this subject are in full accord with our general experience at the model basin. Among the very large number of model experiments we have made, we have had no results indicating any material influence of shape of midship section upon resistance.

For vessels of extreme types and extraordinary speeds there may be great virtue in some special form of midship section—yet to be discovered—but our general model-basin experience and the special experiments described above appear to warrant the conclusion that for vessels of usual types and of speeds in knots no greater than twice the square root of the length in feet, the naval architect may vary widely midship-section fullness without material beneficial or prejudicial effect upon speed.

SHIP YARD NOTES.

The Portland Ship Building Co., Portland, Ore., is getting out two 1,000-ton barges for the Diamond Towing Co., of Portland.

The New York Ship Building Co., Camden, N. J., has a contract for building four steel car floats for the New York Central railroad.

Harry Cossey, Tottenville, N. Y., has a contract for building six grain boats for the New York Central railroad for delivery early in 1909.

The T. S. Marvel Ship Building Co., Newburgh, N. Y., has been awarded contract by the marine department of the New Central railway for the construction of two steel tug boats.

The Palmer Ship Yard at Noank, Conn., is soon to resume operations, having received the contract for repairs to the steamer Erastus Corning of the Starin Line, of New Haven.

E. W. Heath, Tacoma, Wash., is building a power halibut fishing schooner for Larsen & Peterson. She is 66½ ft. long, 15 ft. beam and 6½ ft. deep and is to be fitted with a 30 H. P. Standard engine.

The Union Iron Works, San Francisco, has been doubling the shell plating on the steamer Melville Dollar from the stem aft about 25 ft. The owners decided to take advantage of the dull spell to have the work done.

The United Engineering Co., Alameda, Cal., is engaged in extensive repairs to the steamer M. F. Plant which struck on Coos Bay bar last month. The sternpost, rudder and rudderpost were all removed.

Dunn & Elliott, Thomaston, Me., have nearly completed the four-masted schooner Robert McFarland. All the iron work on the new vessel is being gotten out by an 81-year old blacksmith, Mr. Otis Sidensparker.

Mr. Charles R. Hanscom, president of the Eastern Ship Building Co., has announced that the plant at Groton, Conn., owned by this company, and at which the steamships Minnesota and Dakota were built, is to be sold at auction and probably dismantled.

William Mundey & Sons, San Francisco, Cal., are building a scow schooner for the California Lighterage Co. which is to be the largest vessel of its kind on San Francisco bay. She will cost $13,000 and is to have a capacity of 350 tons.

The Puget Sound Ship Building Co., of Seattle, Wash., which made the repairs to the British steamship Beechley at Portland, Ore., recently has contradicted the reports that the cost of the repairs amounted to more than the contract price. Albert Kelly, president and

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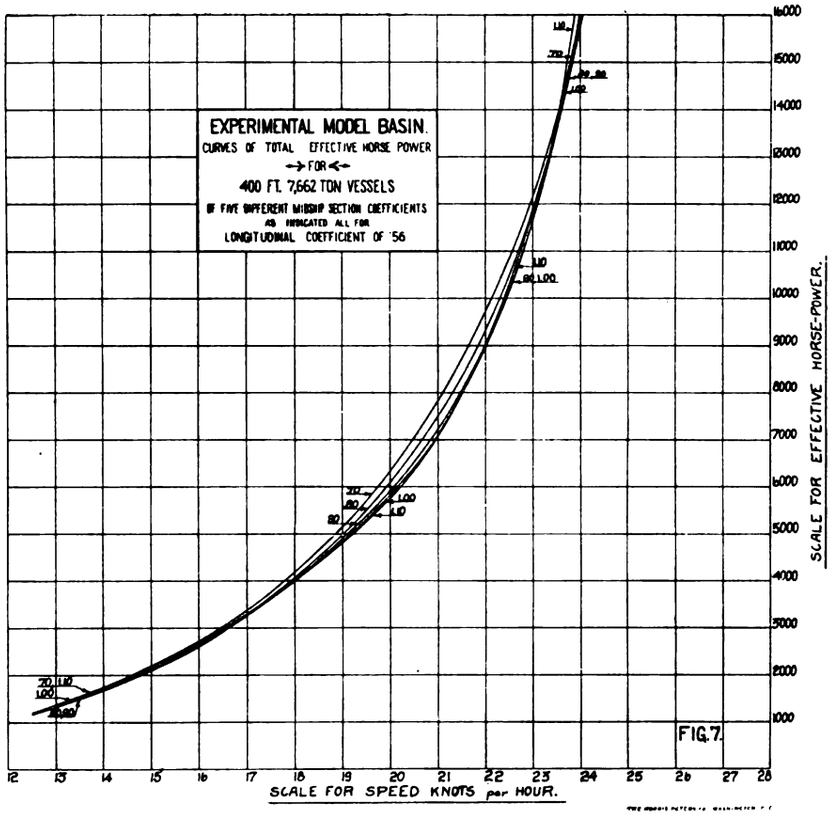

EXPERIMENTAL MODEL BASIN.
CURVES OF TOTAL EFFECTIVE HORSE POWER
→FOR←
400 FT. 7,662 TON VESSELS
OF FIVE DIFFERENT MIDSHIP SECTION COEFFICIENTS
AS INDICATED ALL FOR
LONGITUDINAL COEFFICIENT OF .56
SCALE FOR EFFECTIVE HORSE-POWER.
SCALE FOR SPEED KNOTS per HOUR.
FIG. 7.

Francisco, $11,553, work to be done in 35 working days. The entire main deck of the Manning is to be renewed and as the deck is of pine it means that all the joiner work below deck must be removed and placed ashore. All of the electrical wires, pipes, plumbing and steam conduits, etc., also must be removed and returned to the vessel.

Harlan & Hollingsworth Corp., Wilmington, Del., launched the steel steam lighter Westfield, building for the Central Railroad of New Jersey, recently. The Westfield will soon be followed by the sister ships Keyport and Easton. They are each 110 ft. in length, 30 ft. beam and 12 ft. depth of hold.

Bids for repairing light tender Maple, opened by the light house inspector at Baltimore, Md., on Nov. 11, were as follows: Colonna Marine Railway Co., Norfolk, Va., $489; Smith & McCoy, Norfolk, Va., $528.50. The contract was awarded to the last named bidder.

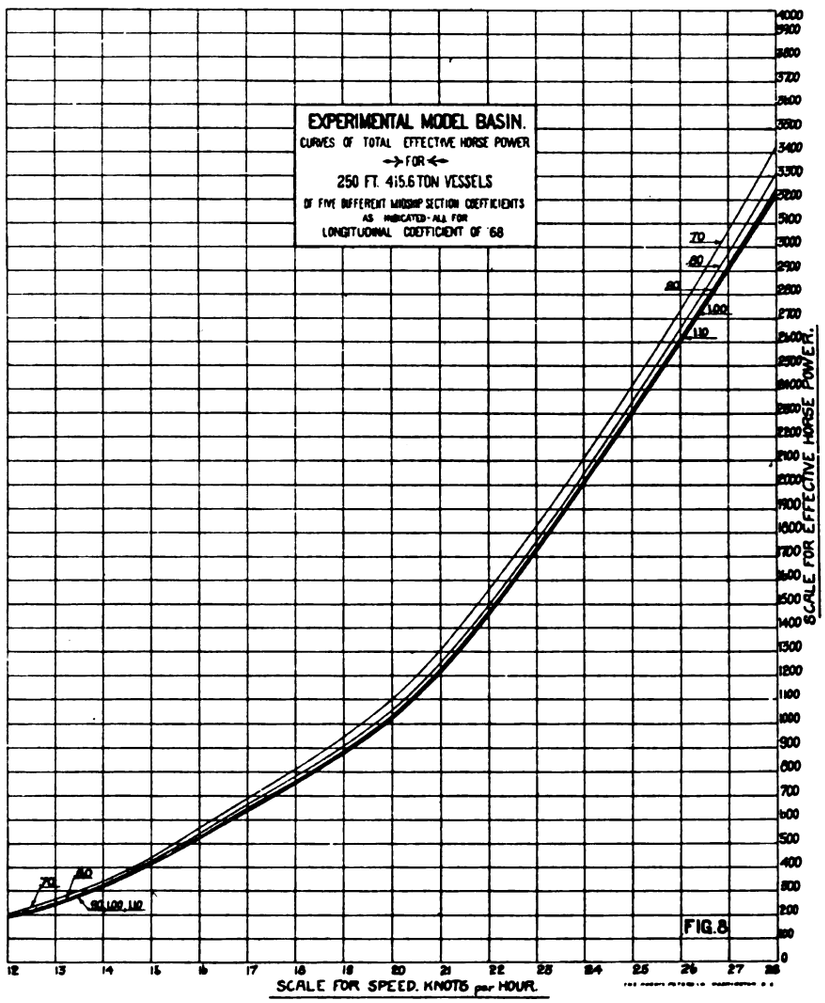
manager of the company, makes the statement that instead of the company losing money the balance was on the right side of the ledger and had it not been for a couple of strikes a handsome profit would have accrued from the job.

The Newport News Ship Building & Dry Dock Co., Newport News, Va., is making repairs to the Merchants' and Miners' line steamship Ontario which was in collision with a freight scow in Boston harbor recently, sustaining damage to several plates.

The Moran Co., Seattle, Wash., has a contract for building a new steel steamer for the lumber trade, to cost $225.000 and have a capacity of 2,000,000 feet of lumber. The name of her owner has not as yet been made public.

M. M. Davis & Son, Solomon's Island, Md., has been awarded contract for a fishing steamer by the Hinton-Tolson-Guano Co., of Reedville, Va. The vessel is to be ready for service in the spring and will be 135 ft. long, 22 ft. beam and 11 ft. deep.

Bids for repairing the revenue cutter Manning were opened on board that vessel at San Francisco recently and found to be as follows: Union Iron Works, San Francisco, lowest bidder, $9,367, the work to be done in 24 working days; W. A. Boole & Son, San Francisco, $13,270, work to be done in 45 working days; Moore & Scott Iron Works, San


EXPERIMENTAL MODEL BASIN.
CURVES OF TOTAL EFFECTIVE HORSE POWER
→FOR←
250 FT. 415.6 TON VESSELS
OF FIVE DIFFERENT MIDSHIP SECTION COEFFICIENTS
AS INDICATED ALL FOR
LONGITUDINAL COEFFICIENT OF .68
SCALE FOR EFFECTIVE HORSE POWER.
SCALE FOR SPEED. KNOTS per HOUR.
FIG. 8.

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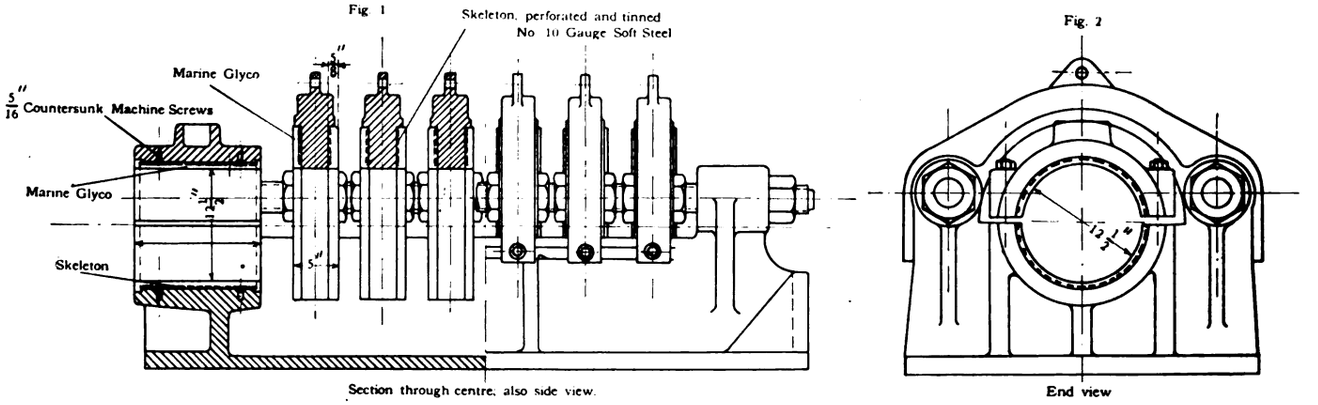
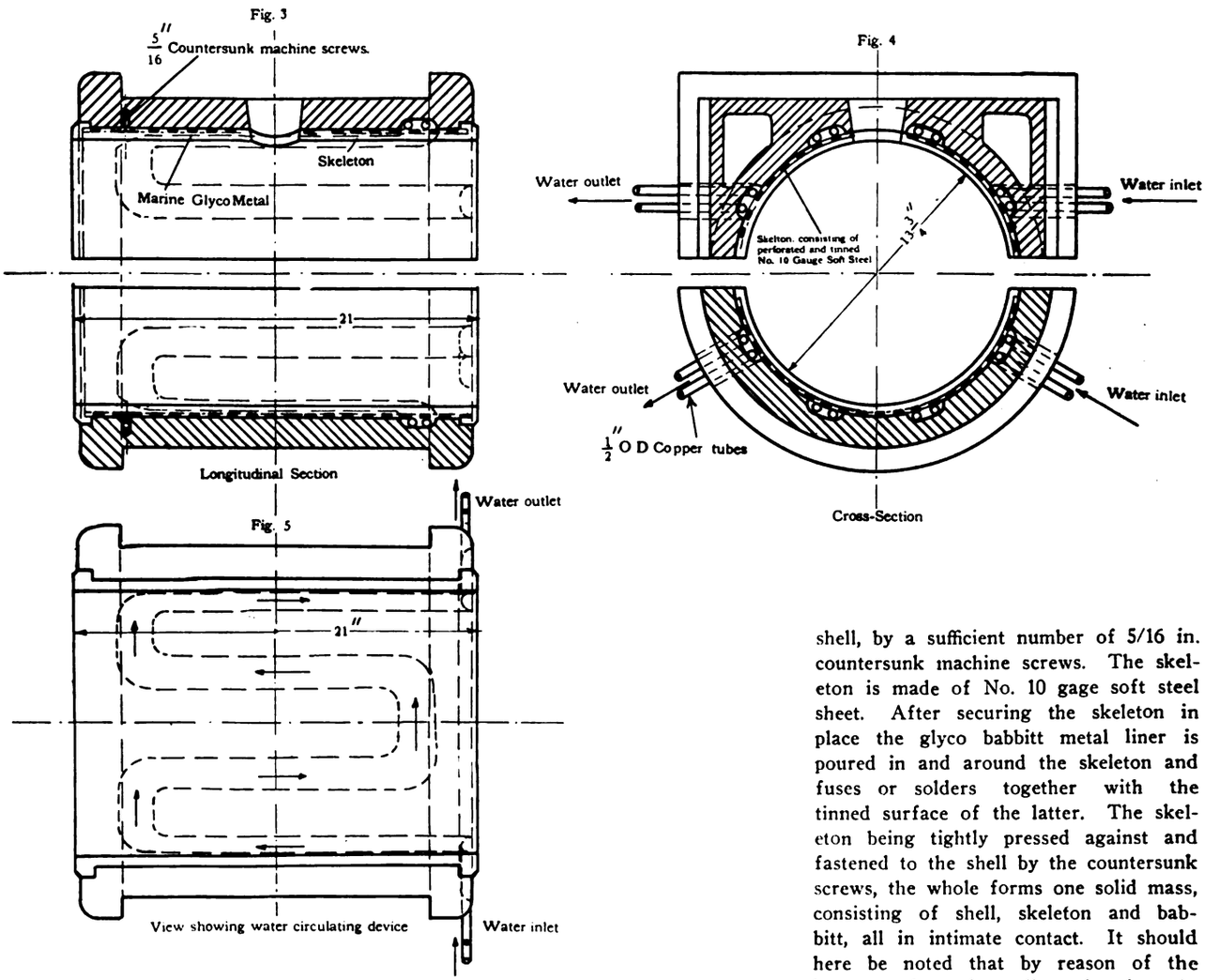
Recent Developments in Bearing Construction for Marine Use.

Some very interesting recent developments in the design and construction of marine bearings have just come to our attention and the following cuts and description will no doubt impress our readers that great improvements have been made. As a large number of these bearings for marine service are built abroad, this construction will be of peculiar interest to marine engine builders of this country. The construction is nothing else than a reinforced babbitt liner for bearings of all descriptions, combining with the reinforcing principle a method of securing or anchoring the liner to the shell.

Figs. 1 to 5 show a shaft thrust bearing and a main engine shaft bearing designed in this glyco patented skeleton construction. Fig. 1 shows the cast iron shell of the after-pillow block designed without any dove-tailed grooves or other anchoring devices for the babbitt metal liner. A perforated and tinned soft steel sheet or skeleton is securely fastened to the plain cored



FROPELLER SHAFT THRUST BEARING AS MADE IN GLYCO PATENTED SKELETON CONSTRUCTION.



MARINE ENGINE MAIN SHAFT BEARING AS MADE IN GLYCO PATENTED SKELETON CONSTRUCTION AND WITH SPECIAL WATER COOLING DEVICE.

shell, by a sufficient number of 5/16 in. countersunk machine screws. The skeleton is made of No. 10 gage soft steel sheet. After securing the skeleton in place the glyco babbitt metal liner is poured in and around the skeleton and fuses or solders together with the tinned surface of the latter. The skeleton being tightly pressed against and fastened to the shell by the countersunk screws, the whole forms one solid mass, consisting of shell, skeleton and babbitt, all in intimate contact. It should here be noted that by reason of the large number of small perforations in the skeleton, the babbitt metal is dis-

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tributed so uniformly over the whole surface of the bearing shell that shrinkage strains and hollow spaces, due to the usual dovetailed grooves and similar anchoring devices are thus avoided.

The strong soft steel skeleton strengthens and supports the glyco babbitt liner,

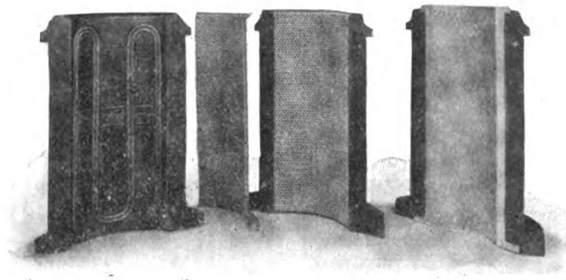

FIG. 6.

just as iron does concrete in our modern building construction, so that even the heaviest shocks will not break the glyco liner. Skeleton construction is also applied to thrust rings as shown in Figs. 1 and 2. Glyco skeleton construction is of great service in the thrust

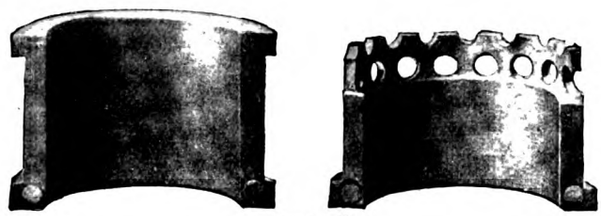

FIG. 7.

bearing particularly, because, as is well known, the babbitt liner is very liable to become loose in this place and it has heretofore been very difficult to fasten or anchor it securely.

Figs. 3, 4 and 5 represent a main shaft marine engine bearing, also equipped with skeleton construction and

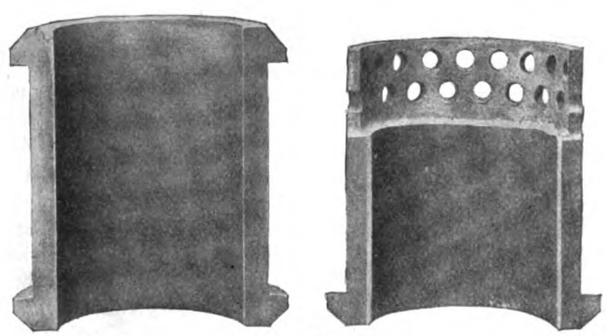

FIG. 8.

marine glyco metal. Here also the skeleton consists of a No. 10 gage, perforated and tinnned soft steel sheet. If desired, the skeleton may be made out of a perforated and tinned bronze sheet.

A special feature of this bearing is the water-cooling device. As may be seen, the cored channels and water jackets, as generally used, are done away with; instead of these, cored grooves are formed in the cast iron bearing surface and a pair of copper tubes ½-in. outside diameter, is inserted. The skeleton protects the tubes against possible injury. After the tinned skeleton is fastened to the cast iron shell, the glyco liner is poured over and the copper tubes are thus embedded in the glyco skeleton liner. The great advantage of this construction is that the cooling device is brought nearer to the wearing surface of the bearing; furthermore, a metal (copper) is employed which has a much higher coefficient of heat-conduction than cast iron, both facts immensely improving the cooling effect. Another advantage is that the casting of the bearing shell is less complicated and therefore the danger of wrecked castings is reduced.

Fig. 6 reproduces a photograph of a glyco patented skeleton construction bearing equipped with this water-cooling device.

Fig. 7 shows a small connecting rod bearing, 1⅞ in. diameter and 1¾ in. length, for a motor boat engine. This bearing, formerly constructed in phosphor bronze, was giving a good deal of trouble. It was then made up, with great success, in what is known as the "second method" of glyco patented skeleton construction. In this method the solid, outside cast iron or cast steel shell is entirely abandoned, as may be seen from the cuts. This type of bearing consists entirely of glyco babbitt metal but to give it the necessary strength, a perforated and tinned soft steel skeleton sheet, ranging from No. 10 gage to ⅜ in. in thickness, according to the size of the bearing, is embedded or cast in the glyco. A principal advantage of this construction is that without increased thickness, a babbitt bearing is created, of the strength of a bronze bearing, but having the superior anti-frictional qualities of the former. These bearings may be cast in special steel dies or molds, which are very exactly machined. Practically no further machine work is therefore necessary and in addition, the sand molding and casting of bronze bearings are done away with.

Fig. 8 shows a main shaft engine bearing of the same design, for 20 H. P. gas engine. This construction is employed for bearings from 1 in. to 6 in. diameter.

Glyco metal and glyco patented skeleton construction have been manufactured in Europe for a number of years, but the rights for America have been taken over by Joseph T. Ryerson & Son, Chicago, and are now made here under the direction of experts in this line. Their engineering department will gladly furnish further information and proposals.

The members of the Ohio Society of Mechanical, Electrical and Steam Engineers who were in session in Toledo last week visited the plant of the Toledo Ship Building Co. during their convention. The ship building company distributed among the members a souvenir giving a few views of the plant.

President Roosevelt is reported to have ordered a walking test for the officers of the navy similar to that prescribed for the officers of the coast artillery. The official order will state that a distance of 50 miles must be covered in three consecutive days and not more than 20 hours is to be consumed.

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THE TWO NEW WHITE STAR LINERS TO BE LARGEST AFLOAT.

We are informed by our British representative that the White Star Line is not yet in a position to give particulars as to dimensions and propelling machinery of the two new steamers for their New York service now being built by Messrs. Harland & Wolff, of Belfast, beyond that they will, in point of size, eclipse everything afloat, including the new Cunarders, Lusitania and Mauretania; that their tonnage will be about 45,000, and their speed not less than 21 knots. They hope very shortly now to have all details settled, and the public will then be informed of the enormous proportions of these two gargantuan steamers, as they are described by the owners. We are able to say, however, that in these two new steamers the numerous innovations devised for the comfort of passengers will come as a revelation even in an age that has already produced such veritable wonders of the sea. They will be named Olympic and Titanic. With regard to the propelling machinery, the owners have not yet made known their intentions as to whether reciprocating engines alone will be used, as in the case of the Adriatic, or whether a low pressure turbine will form an additional part of her engine room equipment. But everything points to the great probability of both these leviathans having engines of this combination. The measure of success that has attended the trials of the first "combination" steamer, the Otaki, built for the New Zealand Shipping Co. by Messrs. William Denny & Co., will doubtless have some effect in deciding the kind of machinery to be used, and further, in a very short time the White Star Co. will have at their command valuable data from the trials of their new steamer Laurentic, which is now completing at Belfast for the White Star Line's new Canadian service, and which is also fitted with a combination of reciprocating and turbine machinery. Certain it is that nothing officially has been made known of the type of engines to be fitted in these ships, but as before stated, everything points to the adoption of a low pressure turbine in combination with reciprocating engines.

RENEWING A TAIL SHAFT AT SEA.

John Marshall, of 14 West Bute street, Cardiff, gives an account of the replacement of a broken tail shaft in the large steam tug Dolphin, belonging to Messrs. S. Pearson & Sons. This vessel was lying in fairly deep water in the harbor of Sulina Cruz, on the Pacific coast of Mexico. In the operation the propeller was first removed by a diver, and then the tail shaft was drawn in towards the engine. To prevent the inrush of water, the diver slipped into the stern tube a taper wooden plug, around which was an indiarubber ring to make it watertight. This was forced in, and afterwards secured by means of a wooden chock wedged in between the head of the plug and the rudder post. The new tail shaft was then put in place. Between the fore-and-after sleeve there were fitted wooden battens to make up the space between the sleeves, and to render the shaft of the same diameter throughout its length. These battens were kept in place by bands of copper wire laid in grooves prepared in the battens to receive them. When the new shaft was in the stern tube the packing and the gland were replaced, and screwed up sufficiently to prevent a rush of water. A jack was then placed at the inner end of the shaft, which was forced into its place, pushing out the plug from the stern tube. The propeller was put on by the diver, and finally hammered up by means of a dolly slung and manipulated from the deck, and guided below by the diver. Mr. Marshall desires to learn if the operation of replacing a tail shaft has ever before been accomplished without putting the ship in dry dock, and he suggestion might be carried out in mid ocean, provided, of course, that the weather gests that his experience in this instance leads him to think that such an operawas sufficiently propitious.

MARINE ENGINEERS' CONFERENCE.

The annual Pacific coast conference of the Marine Engineers' Beneficial Association was held in Seattle, Wash., Nov. 23, 24 and 25. This conference is attended by delegates of the various local associations and is for the purpose of discussing policies and plans for the coming year and to instruct the Pacific coast delegation which is to attend the national conference at Washington, D. C. The delegates were entertained by a grand ball the evening of Nov. 24. The conference was presided over by National Vice President C. S. Follett, of Seattle. Among the prominent delegates who were present were: John Trout, district deputy Yukon river territory; John Searey, business manager, San Francisco, and F. G. Forbes, business manager, Portland, Ore.

SHIP CLEANING DEVICE.

An electric scrubber for cleaning ships' bottoms without drydocking is described by the English correspondent of the Scientific American. As the old-fashioned hogging brush was dragged along, the brooms had the tendency to be bent aft, and to a certain extent to ride over the harder patches of fouling matter. The new device is in effect a flexible hogging brush, which is dragged up and down under the hull by ropes. By the use of electricity the brush is made to cling to the ship's side like a magnet. The mat has a leading batten without a magnet at either end, and six ordinary battens, each fitted with two magnets and a set of brushes between. As soon as hauling commences the battens cant, thus bringing the fore edge of each brush into touch with the hull of the ship. As it is dragged over the fouled surface, the accumulated matter is flicked off. The requisite current is furnished either from the ship itself or from a special tender. It has been found that the total magnetic grip of the whole mat is well over one ton. Experience has shown that a greater grip is requisite for the very hard steel of armor plates than for ordinary steel plates of a mercantile vessel's hull. The strain on the hauling hawsers fore and aft is approximately 1.5 tons. The scrubber requires the attention of only two or three men to work it. An 18,000-ton battleship, it is stated, can be completely scrubbed in 12 hours, and vessels dry docked after being cleaned by this method have been found to be entirely free from any marine growth. A 4,000-ton ship can be cleaned, inclusive of the provision of labor, current, and all gear, for $100, in approximately eight hours.

LAUNCH FROM THE QUEEN'S ISLAND.

On Thursday morning, Nov. 12, the large twin screw steamer Minnewaska, for the London and New York service of the Atlantic Transport line, was successfully launched at Belfast by Messrs. Harland & Wolff, Ltd. The vessel has a gross tonnage of 14,500 and is 616 ft. long, with a breadth of 65 ft. 6 in.

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She will be propelled by two sets of quadruple-expansion engines of the builders' latest balanced type, steam being supplied by four large double-ended boilers and four single-ended boilers fitted with forced draft.

Accommodation will be provided for about 330 first class passengers, and will include dining saloon, lounge, reading room, and smoke room; all tastefully decorated. Large refrigerated compartments are also provided for the carrying of chilled meat.

In addition to the natural ventilation, the vessel will be fitted with a number of electric fans giving efficient artificial ventilation, and she will also have a complete electric light installation.

FROM THE THAMES TO THE CLYDE.

(GLASGOW CORRESPONDENCE *London Times.*)

The new ship building and engineering establishment of Messrs. Yarrow & Co., at Scotstoun, on the Clyde, is now in full working order, all the building slips being occupied, and two torpedo-destroyers for the Brazilian navy—the first fruits of the new works—occupying the covered-in tidal basin which is a unique feature on the river. The engineering and the boiler making sections of the works are now complete, and the boiler making facilities are sufficient to meet any demands entailed by the projected destroyers and other classes of ships of this year's naval program. The works now give employment to considerably over 1,000 men.

Although the Yarrow ship yard is by no means one of the largest ship building establishments in this country, its transfer from the Thames to the Clyde has become so universally known that it may be of interest, now that the move has been effected, to ascertain whether the expectations of the heads of the firm have been fully realized, and, if so, in what respects the wisdom of the move has been proved.

The reason which impelled the firm to leave the Thames for the Clyde was not that of making more or less profit, but of existence, because it was self-evident that the cost of production on the Thames was every day becoming more and more prohibitory, and a move was deemed to be absolutely necessary.

In estimating the relative advantages of various localities suitable for ship building, the following conditions were taken into account:

1. Ample supply of labor.
2. Close proximity to the steel industry.
3. Invigorating rather than depressing climatic conditions.
4. Good educational advantages for the rising generation, and easy range of pleasant residences for staff and workmen.
5. A good measured mile for speed trials.

The locality which seemed to conform best to these conditions was Scotstoun, on the Clyde, and in comparing the cost of production there and at Poplar results have shown that it is less at the new site by 12 to 15 per cent. In London it appeared that all kinds of obstacles were put in the way of the development of the industry. The Scotstoun works are exactly the same size as the Poplar establishment; but, while the rates at Poplar were over £1,600 a year, the present rates are considerably less than half that sum. When the company desired that railway accommodation should be brought into the Poplar yard, various difficulties were placed in the way, while in Glasgow railway facilities were volunteered. Every block upon which a vessel was built, and every necessary pile placed on the foreshore of the Thames had to be paid for, while on the Clyde the authorities facilitated the company without charge in every way, provided it did not interfere with the navigation. In fact, in Glasgow there appeared to be a general desire on the part of public bodies to encourage industries, with a view to promote the general prosperity of the city.

ARMOR PLATE CONTRACTS.

Contracts for 9,418 tons of armor plate for the new battleships Florida and Utah were awarded Nov. 19 by the navy department. The total cost of the armor will be $3,970,303, and the work is to be divided between the Bethlehem Steel Co., the Carnegie Steel Co. and the Midvale Steel Co., all of which put in practically the same bids. The Bethlehem Steel Co., is to furnish 3,137 tons of plate for $1,324,502; the Carnegie mills 3,153 tons for $1,333,095, and the Midvale plant 3,128 tons for $1,312,706.

Secretary Newberry stated that the similarity of bids had no significance whatever, as the mills based their bids on the condition of the metal market and the existing cost of labor, all of them reaching the same conclusion as to price. That all should happen to hit on the same figures, which he said were very low, was due he believed to the close figuring done by the estimators.

ROBERTS BOILERS.

The Roberts Safety Water Tube Boiler Co., Redbank, N. J., has just issued a catalog on its boiler. Quite interesting indeed is the account of the origin of the Roberts boiler. It appears that it was invented by E. E. Roberts, of New York, for use in his own yacht. Mr. Roberts had been for many years an engineer in the regular service of the United States navy, but at the time of the invention of the boiler he was doing business as a consulting engineer in New York. He had lately purchased a summer cottage on the banks of the Shrewsbury river, New Jersey. Doing business in New York and living in New Jersey, did not leave Mr. Roberts much time to enjoy the beauties of the Shrewsbury stream, and the time spent in generating steam in an ordinary boiler was a matter of much delay. The idea of a steady water line, quick steaming water tube boiler, suggested itself to him and he built one which proved entirely satisfactory. This boiler is still in use in the launch Mamie C. The boiler was not originally intended for commercial purposes but the success of the Mamie C was instantaneous and Mr. Roberts was importuned for duplicates, with the result that his business as consulting engineer was eventually abandoned and the Roberts Safety Water Tube Boiler Co. established. Over 1,600 of these boilers are now in use. The catalog contains a great many testimonials and endorsements from users, together with a great variety of photographs of vessels that are equipped with this type of boiler.

"THE RECEEPROCATIN' MON."

(By Robert Burns and others, including Gavin Hamilton.)

Oh, woesome 'oor that saw the birth
O' turbine thochts in Pairsons heid.
I weesh that I wis aff th' earth,
Or else the turbine mon was deid.

I'm a receeprocatin' mon,
I love to hear the bearing bump,
Or yet, the piston groan and grunt,
That's religated tae a pump.

This whurligeegin' thing I hate,
Fur whatna gude is it tea dae?
Tae sae the fearsome thing gyrate
Gars me puir stummick gang aglee.

I widna care if it had ocht
Tae need a tender fitter's haund,
But it rins sae weel sin it was bocht
I hivna had to slack a glaund.

I hate the tribe of whirligeegs,
It's jist a pinch o' steam, then "Scat!"
I'm a receeprocatin' mon,
I stan' or fa' wie Jeemie Watt. —F.

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CONCRETE BARGES SUCCESSFUL.

According to advices received recently from United States Consul Chapman at Rome, the Italian boats and barges built of concrete have proven very successful for harbor purposes, and the builders have at present more orders on hand than they can attend to with their limited plant.

The Gabellini Co., which has been engaged in concrete construction since 1900, built one 150-ton barge in 1905 of reinforced concrete for harbor use, which proved a great success. The next year the firm constructed one barge of 100 tons for the Italian ministry of marine, and upon its being found satisfactory, after repeated trials in the harbor of Spezzia, four others were ordered by the government. The dimensions of these barges are: Length 51 ft., beam 16 ft. They are constructed with double bottoms, divided into watertight compartments, and thus made practically unsinkable.

The barges sell for $290 each. The company has made no experiments so far in installing motive power in boats or barges, but is confident that this can be readily done.

Comparing first cost and endurance in floating constructions of wood and concrete the company states that a wooden barge costing $200 is good for five years' service, repairs entailing an expenditure of 30 per cent of the original price, while often those constructed of concrete have been found to be perfectly sound after eight years in service.

The concrete barges in use for a number of years as supports of a number of floating bridges in Italy, they affirm, show like power of endurance.

The following statements of results by this company, respecting experiments in concrete work, are given:

As is well known, cement, when brought into contact with water, steadily acquires greater compactness and resistant power, and that having attained the maximum in these qualities it retains the same indefinitely, without deterioration. From this consideration came the idea, with full appreciation of the difficulties that must first be overcome, of extending the use of this material to waterborne construction.

While it has been demonstrated that cement possesses the highest degree of resistant power under the strain of compression, this is not the case in an equal measure as respects the strain of permanent tension, and in a still less degree as regards shock resulting from collision. Hence would arise the necessity of constructions in castings of a more or less complicated nature, and the work would require thickness of material that would cause deficiency in buoyancy, unless the constructions were on a very large scale.

After long study and trials the problem found a complete solution in the use of the composition "wired (reinforced) cement of uniform resistance," consisting of a conglomerate of cement, containing in its interior a reticulated skeleton of iron or steel enveloped in sheets of metallic network.

Incrustations which in a short time destroy the smoothness of hulls and thus favor the life and growth of animal and vegetable organism, are entirely avoided in cement constructions. Cost of maintenance is practically eliminated in consequence of the properties of reinforced cement. This is an advantage of great importance over construction in wood or iron, for annual repairs to which relatively large sums, compared with first cost, must be sacrificed.

At the Gabellini establishment various boats have been constructed to demonstrate the advantages above enumerated. Two of these boats have been for a long time in the waters of the Tiber, in the custody of the Aniene Rowing Club and at the disposal of its members, who often use them, without any damage or trace of deterioration having been observed.

THE REPORTED ENGINEERING COMBINE IN BRITAIN.

There is as yet no further development in the effort that is being made to amalgamate the marine engineering firms on the northeast coast of Great Britain, but a significant announcement is just made in a circular to the shareholders of Messrs. Richardson, Westgarth & Co., Ltd., of West Hartlepool, which is one of the participating firms. This circular observes:

"Your directors are unanimously of opinion that the proposed amalgamation of certain marine engineering businesses would be greatly to the advantage of the marine engine industry on the northeast coast. Should the proposed mature, the entire scheme would be submitted to the debenture holders and shareholders of the company for their approval."

In regard to this reported combine, it may be definitely stated that it does not hope to include all the marine engineering firms on the northeast coast, but it is merely a sectional affair covering only the southern portion of the district, the Tyne as yet having given little support to the project. The amalgamation, if it ever becomes a reality, aims at a working arrangement among the firms it will embrace with a proportionate pooling of profits. It is not to be a trust, and there is no intention to put up prices. What is aimed at are reductions in the cost of production, fewer management expenses, the elimination of wasteful competition, the classification and standardization of the different branches of engine work and the consequent redistribution of orders among the various firms. In the language of one of the promoters, all these changes, if carried into effect, will enable the northeast coast to cut in against the whole world. There would seem to be good grounds for believing that this ambitious project may, as far as the Hartlepool district is concerned, be finally arranged, for Messrs. Richardson, Westgarth & Co. intimate that they may decide to make up their accounts to the end of December next in view of the combination going forward.

Judge Putnam, of the United States circuit court at Portland, Me., has entered a decree setting forth that the amount due upon the bonds and coupons of the Consolidated Steamship Lines of Maine is $63,038,200. The court orders that if the indebtedness is not paid within five days after Monday, all shares of the capital stock of the various consolidated corporations mortgaged to the American Trust Co. shall be sold as one parcel. John F. A. Merrill and Albert S. Woodman of Portland were appointed special masters to conduct the sale. A draft decree submitted to Judge Putnam today gives stockholders of the Eastern Steamship Co. until Nov. 24 to appear with funds sufficient to pay outstanding claims, and orders the assets of the company sold at auction within one month after the date mentioned. An upset price of $1,250,000 for the assets is fixed. Judge Putnam announced that formal entry of the decree would be made at Boston.

The crew of the schooner Jennie Thomas, of Savannah, Ga., were taken off that vessel by the steamer Afghanistan, bound to New York from Arabian ports, the Thomas having been blown 400 miles out of her course, she was in danger of going to pieces.

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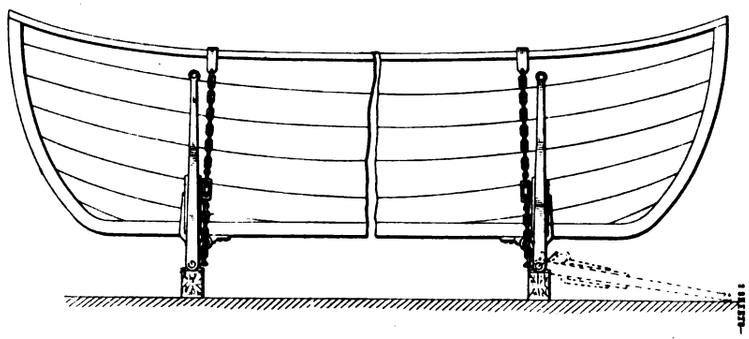
THE RYAN-TANNING BOAT HANDLING DEVICE.

The accompanying drawings illustrate in detail one of the most recent and important additions to lifeboat handling gear, the invention of Lewis Tanning and William J. Ryan, of New York City. The apparatus is designed to enable a lifeboat to be readily raised from the boat chocks normally supporting it, and to be otherwise made ready for immediate action upon the water.

Fig. 1 is a side elevation showing a boat supported upon the chocks and the mechanism in position to enable either or both ends of the boat to be raised slightly from the chocks, this view further showing the means whereby the gunwales are held securely while the boat is out of use. Fig. 2 is a front elevation of the mechanism shown in Fig. 1, this view particularly showing the position occupied by the chocks while supporting the boat, and also showing one of the rollers engaged by the keel and adapted to lift the boat by the partial rotation of a hand-operated lever. Fig. 3 is an enlarged fragmentary section upon the line 3-3 of Fig. 2, looking in the direction of the arrow, this view showing one of the rollers supporting the keel, and further showing a bracket serving as a stop for limiting certain movements of the roller; Fig. 4 is a fragmentary section upon the line 4-4 of Fig. 2, looking in the direction of the arrow, showing one of the chocks and the rocking shafts whereby both chocks are supported; and Fig. 5 is a fragmentary section upon the line 5-5 of Fig. 2, looking in the direction of the arrow, and showing one of the spurs whereby the gunwale chains are normally held down while the boat is out of action.

Fig. 1.



L. TANNING & W. J. RYAN.
BOAT HANDLING DEVICE.
APPLICATION FILED APR. 10, 1906.

903,095. Patented Nov. 3, 1908.

Fig. 2.

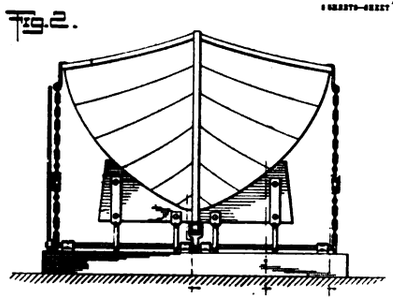


Fig. 3.

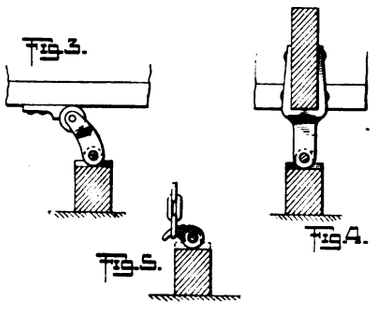


Fig. 4.

Fig. 5.

Resting upon the deck of the vessel are cross beams upon which are bearings supporting a rocking shaft, these bearings having nearly the same length as beams. Two arms are secured, one upon each shaft, these arms being upon the same side of the boat. The chocks supporting the lifeboat are mounted upon arms rigidly secured upon the shafts. Mounted on each shaft is a spur engaging the lowermost links of the securing chain, these chains being provided with turnbuckles whereby they may be adjusted slightly as to length. The upper ends of these chains are provided with gunwale hooks which engage the gunwales of the boat. Mounted upon the keel of the boat are brackets, and rollers, each having substantially the same thickness as these brackets, are mounted upon forks rigidly secured upon the rocking shafts.

The boat, when removed from the water, is rested upon the chocks, as indicated in Fig. 2, the arms being brought into vertical position as shown. The gunwale hooks are next hooked upon the gunwales, and the levers moved slightly to tighten the chains, after which the turnbuckles are adjusted to remove any inequality in the length of the chains. This secures the boat.

To get the boat into the water the arms are turned by hand, as indicated by dotted lines in Fig. 1, and the shafts turn slightly and move the spurs, thereby slackening the chains. The gunwale hooks may now be removed from the boat if desired, or, if not, they may be left secured in position, the loose chains being thrown into the boat. The same movement of the shafts causes the forks to turn, thereby slightly lifting the keel and raising the entire boat for an instant only, to disengage the spurs from the gunwale chains. A continuation of this movement disengages the boat entirely and leaves it hanging in the fall, ready to swing out.

It will be noted that when the parts are in their normal positions, as indicated in Fig. 1, the weight of the boat tends to keep the forks slightly inclined towards each other, so that the rollers engage the brackets, serving as limiting stops for same.

The Ryan-Tanning boat handling apparatus can be installed with any size or build of boat and is comparatively inexpensive. It is manufactured by the Boat Handling Gear Company, 91 Wall street, New York City, the Great Lakes representative being C. F. Coburn, 17-21 State street, Chicago, Ill.

BROWN HOISTING MACHINERY.

The Brown Hoisting Machinery Co., Cleveland, have just issued a catalog descriptive of the Brownhoist grab buckets and tubs. As is usual with all the literary productions of this company, the catalog is exceedingly well printed. The buckets are thoroughly described and are most carefully illustrated with photographs and line drawings. Tables of dimensions are given and the catalog contains full instructions for ordering. The catalog also contains a profusion of full page illustrations of the buckets in actual service as well as a number of testimonials in facsimile. The Brownhoist buckets have won for themselves an enviable reputation throughout the world.

The new lighthouse on the Harbor of Refuge, Delaware Bay, has been completed. The light flashes at intervals of 12 seconds, with a red sector showing to the southeastward. The lighthouse has the only light of its kind in the district, and cost $10,000.

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THE MARINE ENGINEER'S LIBRARY.

The marine engineer is wealthy in the selection of books at his disposal dealing exclusively with his branch of the engineering profession. The entire field is well covered, no unit of a ship's machinery being considered too insignificant for thorough consideration and no type too obsolete. In addition to exhaustive treatises on the various types of reciprocating and turbine engines, books dealing with the uses of electricity, the installation and care of the various systems of refrigerating machinery, marine propellers, the several types of steam generators and the separate units comprising the auxiliary machinery of a vessel, are numerous. Great care has been taken in the preparation of these works, the marine engineer having more than a fair knowledge of what his requirements are in this direction and a habit of denouncing that which fails to meet them.

There can be no doubt that the vast strides which have been made in marine propulsion and equipment during the past decade and the desire of the marine engineer to keep up with the march of progress are responsible for the preparation of the aforementioned books. The position of the engineer is unique in that, while attached to his ship and responsible for the condition of the type of machinery peculiar to his class of vessel, he is debarred from acquiring more than a superficial knowledge of the equipment and handling of other types of vessels. Hence his desire for printed matter dealing with these other types. To board a turbine-propelled vessel in port, when the machinery, with the exception of such as may be in operation for the handling of freight, is cold and lifeless, may be a very gratifying experience to the man ashore, but to the engineer anxious to see the "job" under way it is far from satisfying.

The majority of technical books along these lines are of foreign authorship, and in case of books written by British authors have in many cases been written with a view to educating the applicant appearing before the Board of Trade for an engineer's certificate. An engineer may have an extensive acquaintance with several types of reciprocating engines, but a lack of knowledge where turbine, oscillating or like type, and gasoline engines are concerned is sufficient to "plough" the applicant, or at least send him down for a few days, after which period he is at liberty to make application for another examination. It is unofficially pointed out that a British second class certificate entitles the holder to the position of second engineer on any size of vessel equipped with any type of machine, so a working knowledge of all types of engines must be one of the assets of the applicant. In vessels installed with electric light and power it is customary to carry one or more electricians, and in the larger class of vessel the engineer finds his time entirely taken up with the propelling engines and their auxiliaries. In cases of this kind the engineer is little better off than his brother on the tramp ship equipped with oil lamps, and has to glean what knowledge he can from books on the subject.

There are vessels sailing out of New York on which two entirely different types of refrigerating machinery are installed, one system being in use many years and the other of comparatively recent installation. In ships of this class the engineer comes in close—too close, occasionally—contact with the practical side of refrigeration, but installations of this type are rare. There are more than two systems of refrigeration, however, but books on refrigeration have the various systems entirely covered.

In addition to the above we have engineers' handbooks devoted to the marine branch of the profession, books which deal with every problem the engineer has to contend with and which are revised from time to time to keep engineers fully informed on all matters pertaining to marine propulsion and equipment. So the marine engineer has his share of the good things in life, so far as technical literature is concerned.

NAVIGATING IN FOGGY WEATHER.

The fall of the year with its attendant fogs and accidents to shipping resulting therefrom is a pertinent time to discuss the efficiency of the present government regulations regarding the navigation of steamers in foggy weather. These rules, while eminently satisfactory in the main to coastal practice, are, in some important details, inconsistent with the present conditions of navigation, and on this account a strong sentiment exists among masters and owners of steam vessels, particularly those operating in crowded inland waterways such as the coastal harbors of the Pacific coast, that in certain details the rules should be radically revised.

The present inconsistency of the regulations is due to the fact that they were formulated some 20 years ago and have been scarcely changed since. In those days the fastest inland steamers made little better than

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12 knots while today there are many operating at 20 knots or over. Formerly traffic, specially on the coastal waters of the Pacific, was much less dense than it is now and fog navigation was correspondingly safer. Finally certain rules regarding the speed of vessels in a fog are absolutely at variance with the necessities of the situation.

On short runs through tortuous channels infested with tides and currents where navigating in a fog is by dead reckoning, based on previous observations of courses, times and distances over the same route under similar conditions of tide and weather, the master must either run his vessel at full speed (the speed at which his observations have been taken) or anchor. If he goes at half speed, frequently checking down completely, he will soon be utterly lost. Yet rule 15 of the inland rules of the road requires a vessel proceeding in thick weather to go at a moderate speed and to navigate with caution. Instance after instance where vessels in a tide-way have got off their course and ran aground due to proceeding at speeds other than those at which the observations were taken, including the grounding of the United States cruiser Colorado at Lip Lip Point, Puget Sound, last September, show conclusively that the safest navigating in a fog, so far as the danger of running aground is concerned, is at full speed. At this speed the position of the vessel will be known at all times.

While the above is true, there is, however, greater danger of colliding with other vessels when running at full speed. This danger is heightened by the inadequacy of the fog signaling rules and could be greatly lessened by their proper revision.

These rules at present require a vessel under way in a fog to sound one long blast of the whistle at frequent intervals. While this signal gives some knowledge of the position, it provides no way of knowing in what direction or how rapidly a vessel is moving. The following modifications of the rule have been proposed to obviate this difficulty:

A vessel entering port from sea should sound one long followed by one short blast of the whistle; a vessel leaving port, bound out, should give one short followed by one long blast; a vessel slowing down from full speed to half speed shall sound one short blast; changing from half to full speed, two short blasts; a vessel crossing the fairway of any port should sound one long blast. These signals are merely suggestive but show how the rules might be improved so the direction and speed as well as the position of a vessel running in a fog could be accurately known.

Accidents in fogs on our coastal waters are on the increase and it is to be hoped that some action will be taken to revise the rules governing fog navigation, bring them up to date and take such steps as will lead to increased safety both to the public and to shipping.

CONTRACTS FOR LAKE VESSELS.

The Michigan Alkali Co. has closed contract with the American Ship Building Co. for a freighter to be operated in the limestone trade between Alpena and the company's plant at Wyandotte. This steamer is to be a companion boat to the Wyandotte, which was built earlier in the year, but is to be 70 ft. longer, being 376 ft. long, 45 ft. beam and 26 ft. deep. She will be built at the Wyandotte yard and will be the first vessel constructed at that yard since the plant was shut down several months ago.

James C. Wallace, president of the American Ship Building Co., has closed contract with furnace interests east of Buffalo for a new freighter to be 524 ft. over all, 504 ft. keel, 54 ft. beam and 30 ft. deep, with hatches spaced 12 ft. centers. This makes the sixth bulk freighter contracted for with the American Ship Building Co. within the past two months.

The Northern Navigation Co. of Ontario has given contract to the Collingwood Ship Building Co., Collingwood, Ont., for the construction of a small passenger steamer for Georgian Bay service. The steamer will be 150 ft. long, 25 ft. wide and 9 ft. deep.

Antonio C. Pessano, president of the Great Lakes Engineering Works, has closed contract with Mr. G. A. Boeckling, president of the Cedar Point Resort Co. for the construction of a double-ended, side-wheel ferry steamer, 151 ft. long, 48 ft. beam, with a capacity for 1,500 passengers for service at Cedar Point. The steamer will have an average working speed of 12 miles an hour. In her design special attention will be given to the handling of the largest number of passengers in the shortest possible time. The steamer will be designed to unload the full number of passengers in less than five minutes.

A name has not yet been selected for the steamer. It is understood that the management of the Cedar Point Resort Co. will arrange a voting contest in the various cities and towns in Ohio to select some young woman as sponsor and also a name for the new steamer.

Mr. Pessano has also closed contract with Mr. O. E. Dunbar, treasurer of the Dunbar & Sullivan Dredging Co. for four steel lighters to be used by the company in their stone trade. The lighters will be named Ulster, Munster, Leinster and Connaught after the four provinces of Ireland. They will hail from Buffalo.

Mr. Pessano also closed contract with the Inland Navigation Co. (R. O. and A. B. Mackay) of Hamilton, Ont., for a bulk freighter to be 500 ft. long, 56 ft. beam, and 30 ft. deep.

FREIGHT SITUATION.

Insurance on the lake fleet will expire at noon on Saturday. Very few, if any, boats will operate under the excess insurance rate. In fact, some of the leading fleets, notably the Pittsburg Steamship Co., have already sought winter quarters. The season is ending very quietly, with a movement of ore of about 25,000,000 tons.

The grain trade has been the interesting feature during the closing days. Grain shippers are anxious to forward considerable quantities and bidding for vessels was active, both for shipment and for storage. In fact grain was flowing freely into the elevators and shippers were anxious to get it aboard ships to be held until spring. The rates went to 4 cents.

The Risdon Iron Works, San Francisco, Cal., have been awarded contracts for the construction of two new fireboats for that municipality. They are to be named David Scannell and Dennis T. Sullivan, respectively, and will each be 129 ft. long, 26 ft. beam and 12 ft. 9 in. deep. They are to be equipped with Babcock & Wilcox boilers.

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New Colman Dock at Seattle.

BY H. COLE ESTEP.

Seattle is the home port of the largest fleet of small, fast passenger and package freight steamers on the north Pacific coast. These boats ply different routes on Puget Sound, connecting the various surrounding points with the metropolis and each one calls at Seattle from one to five times daily. Heretofore these steamers have used the several piers along the water front extending from Spring street to Jackson street, a distance of nine city blocks. This separation of the purely local Puget Sound freight and passenger traffic among so many docks has proved a source of considerable inconvenience; some local freight has had to be transferred from pier to pier, while passengers and their baggage going from one point on the Sound to another via Seattle have often met with the same annoyance. The situation was analogous to that which would ensue were the local trains entering the city to be divided among seven or eight depots instead of using one union station. Furthermore the growth of the ocean, Alaska and heavy freight traffic of the city has made it necessary to turn over several down-town piers almost exclusively to seagoing freight and passenger vessels. These conditions have made necessary a union wharf at which as much as possible of the local Puget Sound business could be concentrated and kept together. The new Colman dock at the foot of Columbia street, now practically completed, fulfills this need admirably. The new dock not only provides a pier for the local steamers to land at but also contains offices used by a large number of the steamboat, marine and stevedoring interests of the city.

Columbia street pierces the center of the business section of Seattle, crossing each of the main thoroughfares in turn, and the Colman dock, located at its lower end, has for many years played an important and interesting part in the marine development of the city. The dock was first built in 1882. At that time it was a light, wooden structure, only 40 by 60 ft. in size and rented for $25 per month. About 1886 the dock was rebuilt and slightly enlarged. Again in 1890, when Seattle had attained a population of 45,000, the wharf was enlarged to its present width and extended to a length of 192 ft. Construction work on the new dock, which is over 700 ft. long, was commenced May 30, 1908. Since that time but three working days have been lost on account of rain, a good criterion of the constancy of Puget Sound weather.

The new dock is 705 ft. in length from the west line of Railroad avenue to the outer end of the pier and 110 ft. in width over all. The eaves are 24 ft. and the peak of the roof is 52 ft. from the dock floor. The entire structure is of wood, slow burning mill construction being used throughout. The outer end of the dock is beveled somewhat more than is necessary to make it correspond with the harbor line in order that approaching steamers may land more easily. This outer triangular end is two stories high, there being a large waiting room, surmounted with a dome on the second floor. At the extreme end of the dock is a clock tower 16 ft. square and 72 ft. high. Thirteen ft. from the main floor is the mezzanine floor, or balcony, extending the full length of the north side of the dock. This floor, which is 27 ft. wide, is

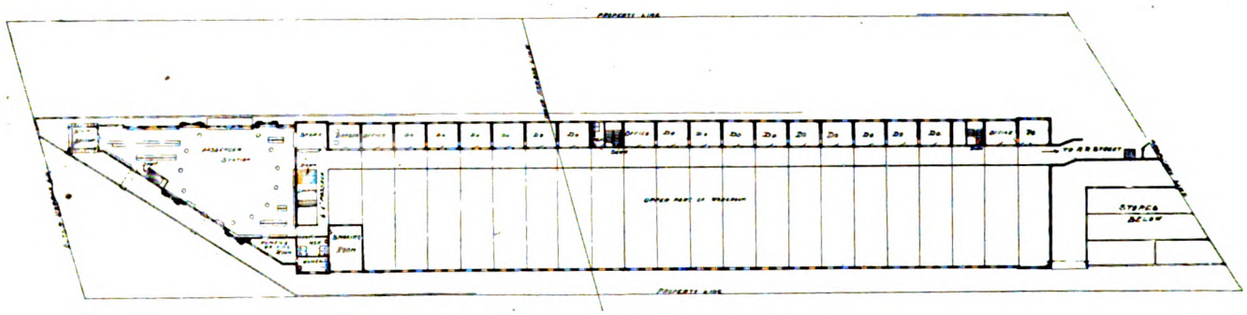

FIG. 1—GENERAL PLAN OF COLMAN DOCK.

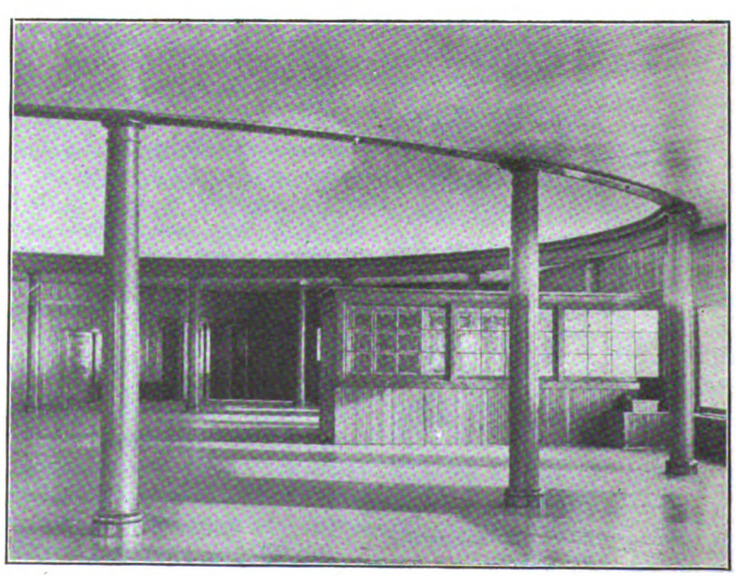

FIG. 2—SECTION OF THE MAIN WAITING ROOM, COLMAN DOCK.

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divided into offices and also provides an 11-ft. unobstructed walk from the main waiting room to Railroad avenue.

The new dock is supported by 950 creosoted fir piles, varying in length from 80 ft. at the outer end to 50 ft. at the inner end. Creosoted piles in this water will last from 10 to 25 years, whereas untreated piles are destroyed by toredos in from one to three years. The penetration of the piles varied from 10 to 20 ft., the bottom being sand underlaid with blue clay. Under the dock floor the piles

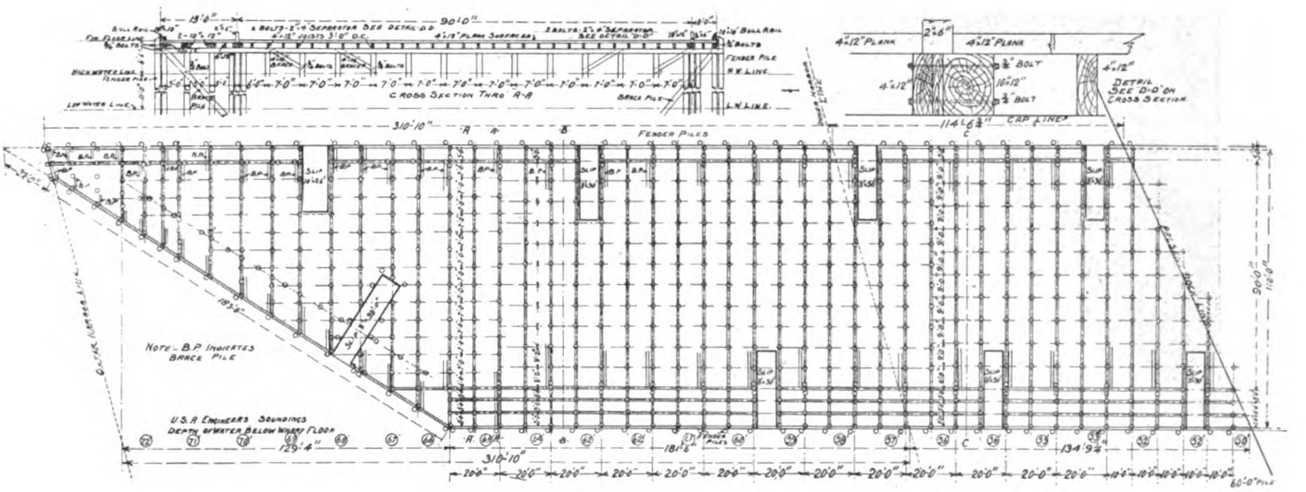
CROSS SECTION THRU A-B
FENDER PILES
CAP LINES
NOTE - B.P. INDICATES BRACE PILE
U.S.A. ENGINEERS SOUNDINGS DEPTH OF WATER BELOW WHARF FLOOR
310'-10"

FIG. 3—PILING PLAN OF NEW COLMAN DOCK.

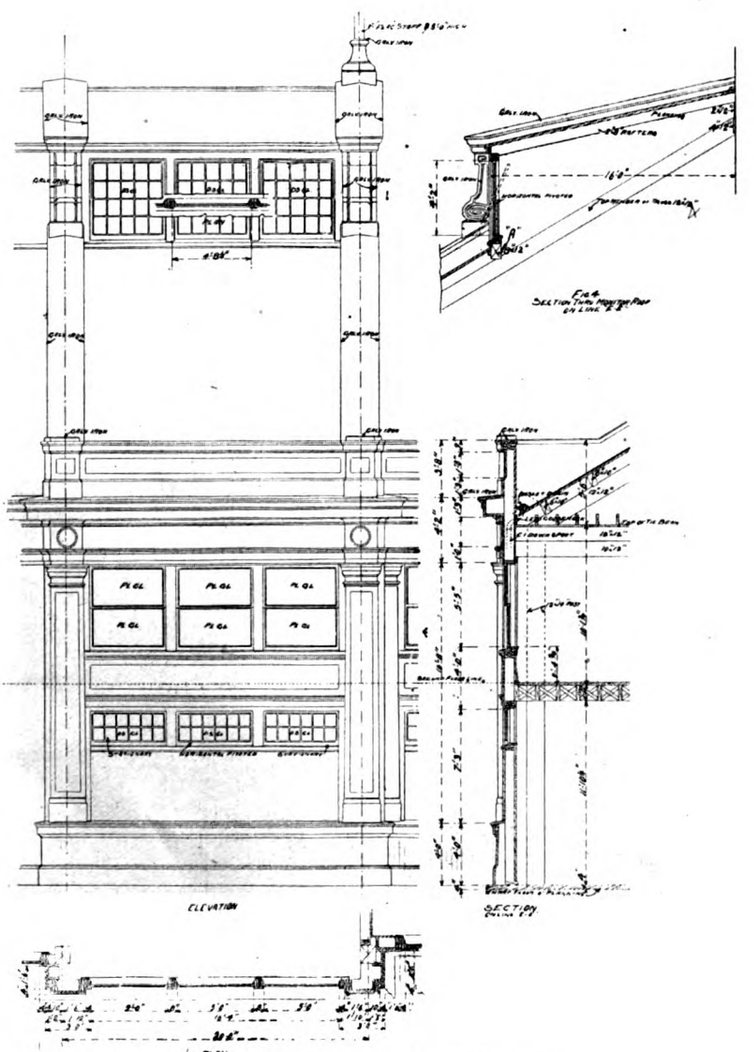

FIG. 4—SECTION THROUGH ROOF.

are driven in rows, 10 ft. between the rows with the piles in each row varying from 10 ft. center to center at the shore end to 7 ft. at the outer end. The walls and roof of the building are supported by a row of piles spaced 9 ft. center to center, with two extra piles, making three in a close group, driven every 20 ft.; the railroad spur is supported by a row of piles under each rail, spaced 9 ft. centers. On the piles are placed 12 by 12-in. caps which in their turn support the joists and beams. The main floor consists of a single layer of 4-in. closely laid fir planks. The floor has an area of approximately 57,740 sq. ft. and is designed for a maximum load of 150 lb. per sq. ft. The walls and roof are carried by 12 by 14-in. fir posts spaced 20 ft. apart. The south and north sides of the dock are finished with rustic siding; the outer facade is paneled and finished in matched 3-in. flooring laid vertically.

An interesting feature of the pier is found in the method of supporting the monitor roof. In all the other docks in Seattle these roofs are supported by heavy auxiliary trusses resting on the main trusses. The method used in the Colman dock is shown clearly in Fig. 4. The top chords of the main roof trusses are carried to the apex of the monitor roof, which is supported at these points and also by 8 by 12-in. stringers shown at "A," Fig. 4. This construction is

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FIG. 5—INTERIOR OF COLMAN DOCK LOOKING TOWARD OUTER END OF PIER.

much lighter, cheaper and yet in every way as serviceable as the ordinary method using auxiliary trusses. The whole roof is supported by substantial wooden trusses, the main chords being built up of six 2 by 12-in. planks, reinforced by a ⅜ by 3-in. iron strap on each side. These trusses, which are spaced 20 ft. centers, are supported by posts and groups of piles as previously described.

The dock is provided with 14 slips, or boat landings, placed at equal intervals completely around the pier. These slips are all adjustable to accommodate the changes in tide, which average 11 ft. daily. The slips are 30 ft. long and 8 ft. wide, counterbalanced, hinged at the inner end and are raised and lowered by two heavy chains, each chain being wound on a drum rotated by a worm gear. Two men are required to raise or lower a slip.

The mezzanine floor along the north side of the dock is fastened to the wall posts along its outer edge, while the inner edge is suspended from the roof trusses by 1-in. iron rods, the rods being in groups of two 20 ft. apart. The floor is divided into 22 offices, each 15 x 19 ft. in size. In addition to an inclined walk which leads directly from Railroad avenue, this floor is connected to the main floor of the dock by three stairways situated at convenient intervals.

No pier on the coast has better passenger accommodations or better facilities for handling passenger traffic than the new Colman dock. Between the shore end of the pier and the business section of the city lies Railroad avenue. Although not yet built, an overhead crossing to carry the people over the railroad tracks is to be constructed, starting from Marion street and First avenue and leading to the West Seattle ferry building immediately adjacent to the Colman dock. From here a walk will connect directly with the mezzanine floor, which in turn leads to the waiting room at the outer end of the pier. Passengers who arrive from the Railroad avenue level can reach the mezzanine floor by means of the inclined walk mentioned above, or by any one of the stairways.

It is intended to keep the passenger traffic as much as possible off the main floor, which will thus be kept clear for teams and freight. From the shore end of the dock the passengers proceed along the public balcony in front of the offices to the waiting room and passenger facilities provided on the second floor at the outer end of the pier. Here is located a splendidly appointed waiting room, triangular in shape, 120 ft. long and occupying the full width of the dock. Connecting with this waiting room are ticket offices, a lunch room, a 19 x 27-ft. smoking room, a ladies' retiring room, and unusually completely equipped toilet facilities.

The waiting room is neatly finished in fir, with a polished fir floor. A

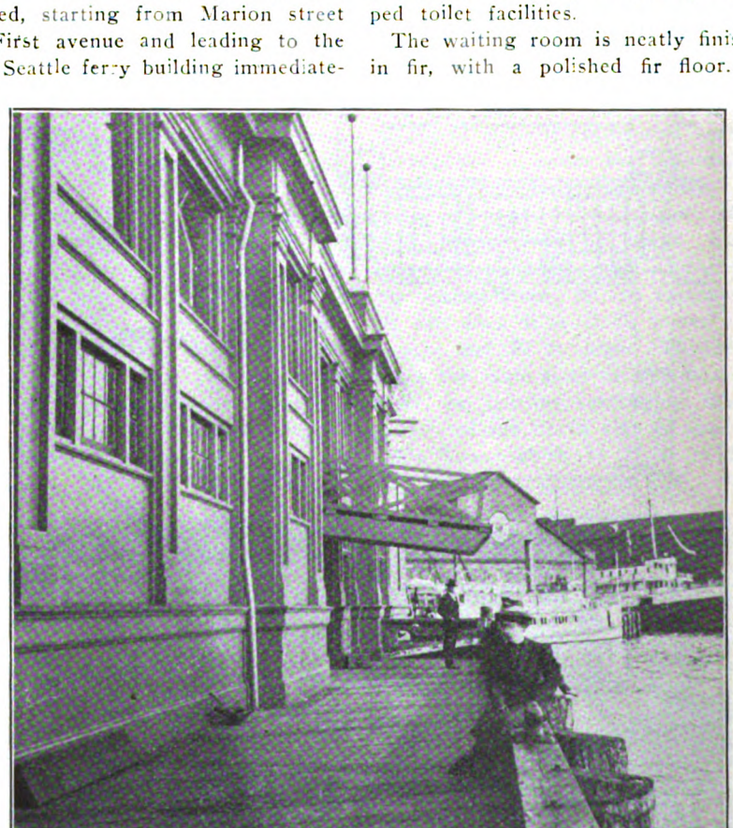

FIG. 6—SOUTH FACADE OF COLMAN DOCK SHOWING ELEVATED SLIP FOR LANDING PASSENGERS ABOVE THE FREIGHT TRAFFIC LEVEL.

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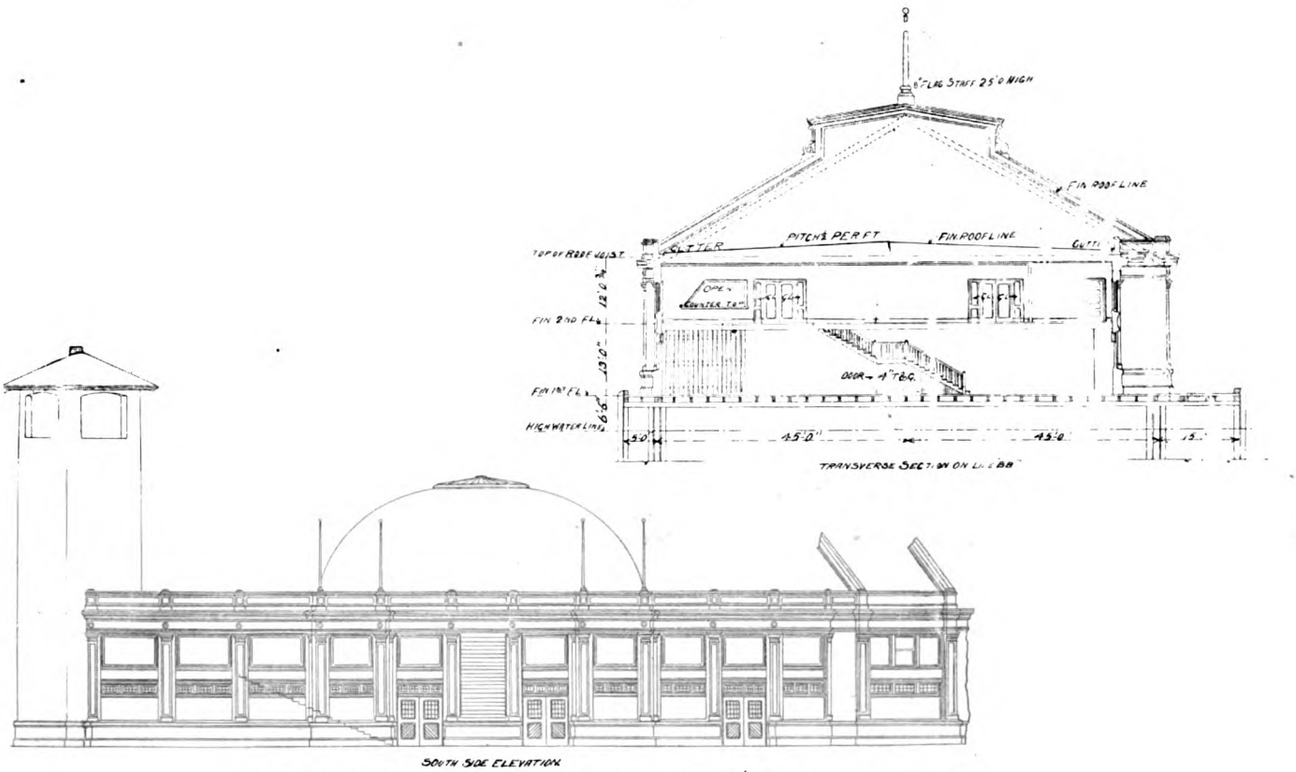
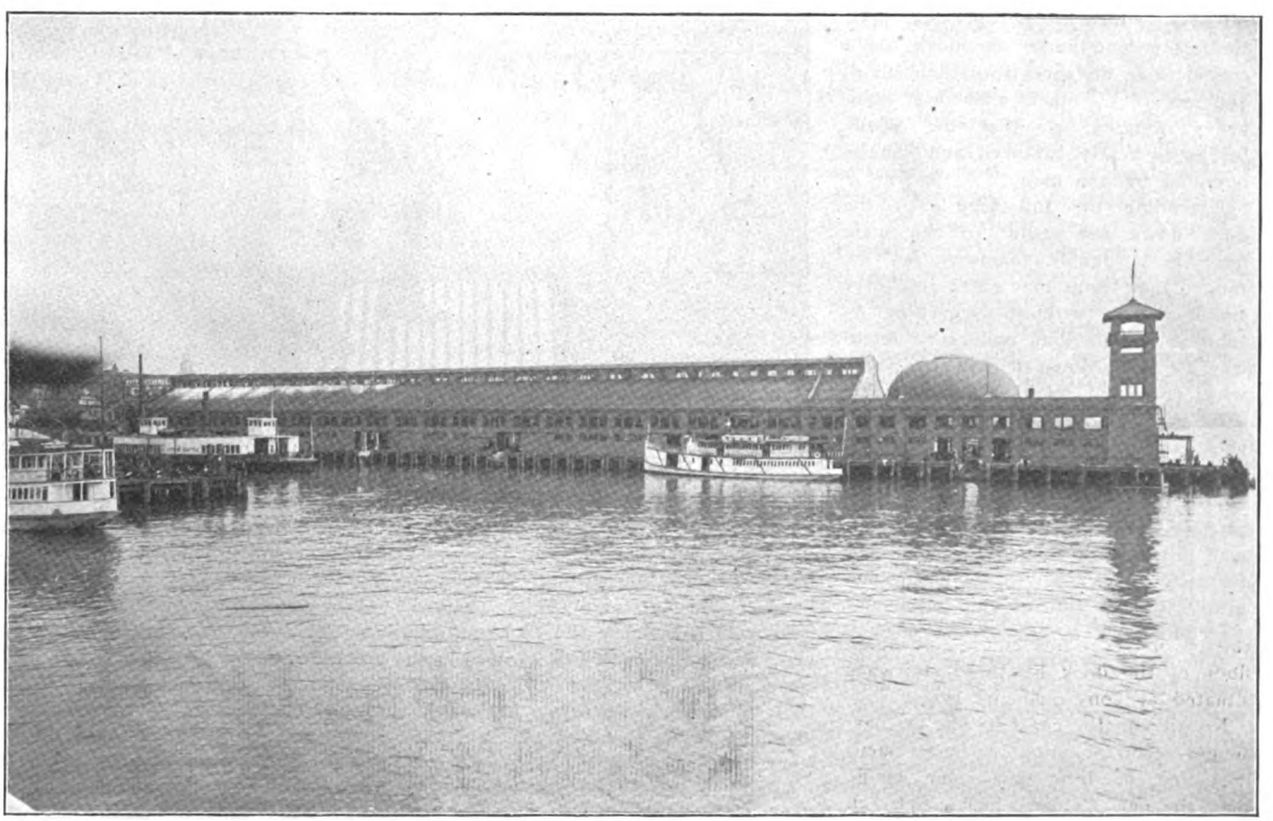


FIG. 7—SOUTH SIDE ELEVATION AND CROSS SECTION OF NEW COLMAN DOCK.



NORTH SIDE OF NEW COLMAN DOCK AT SEATTLE.

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plastered dome 60 ft. in diameter gives the room a pleasing, vaulted appearance. As is seen from the photograph, Fig. 2, this dome is supported by 12 doric, fir columns. Seats are arranged under the dome in concentric squares. An adjustable slip leads directly from this room to the steamer lying alongside. Since the steamers only occupy a few minutes receiving or discharging passengers, the one slip can accommodate a large number of boats arriving at different times.

Almost the entire lower floor of the dock is available for handling freight. Freight enters and leaves the dock either on railroad cars or by team. Along the south side of the dock is the railroad spur, so arranged that heavy freight may be transferred directly from the cars to vessels. This spur crosses three slips and at each crossing is an interesting movable bridge, so designed that the track will be out of the way when the slip is in use. This design permits both slips and a spur on the same side of the dock. The crossing consists simply of two 15 x 18-in. timbers laid under each rail across the 8-ft. gap in the continuous floor caused by the slip. These timbers are hinged at one end and swing out of the way in exactly the same manner that the familiar lift draw-bridge operates. The timbers extend under the dock for a considerable distance from their pivot, and on these inner ends are hung heavy weights, so that the whole bridge is neatly balanced and can be operated by one man.

Extending the full length of the dock down the center of the main floor is a double teamway, so arranged that teams may enter and leave simultaneously without congestion. As soon as the planking under this teamway is worn down it will be paved with creosoted wood blocks, which make a much more satisfactory roadway than planks.

Fire protection was given thorough consideration in the design of the pier. At the shore end is a solid 6-in. wall fitted with fire doors which effectually stops the strong draft naturally flowing toward the outer end. Extending the length of the dock is a 6-in. main carrying city water, from which is tapped five 2½-in. standpipes, fitted with 2-in. Fearless underwriters' hose.

The dock is well lighted by electricity obtained from the local lighting mains. Five flaming arcs are used to light the main floor. It was found that these five flaming arcs give more satisfactory illumination and consume less current than 14 ordinary arcs.

Another distinctive feature of this pier is that it is provided with a complete, independent steam heating system. Steam is generated in a locomotive boiler burning mill slabs. The system cost $3,500 and was installed by the Seattle Heating & Plumbing Co.

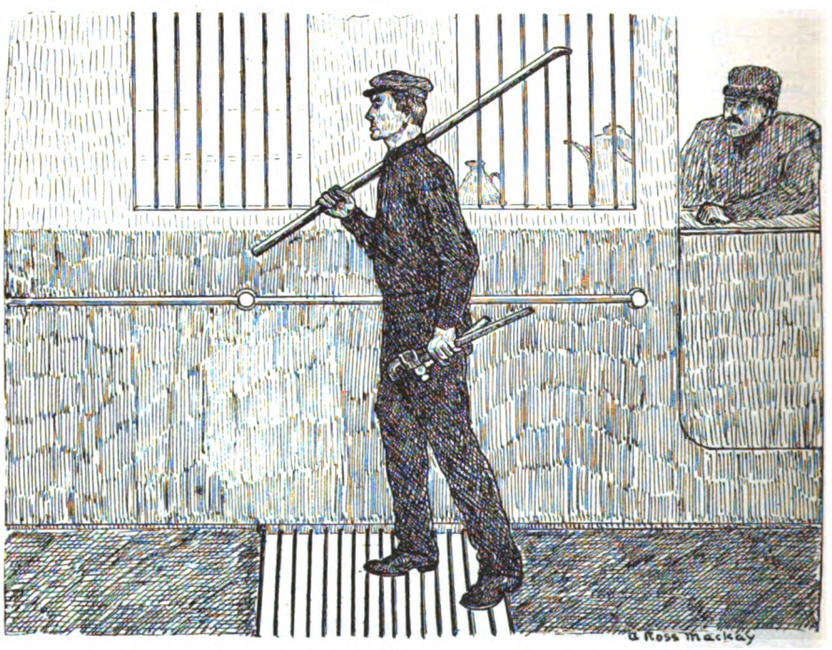
The pier will cost complete about $100,000. It will be used by 10 Puget Sound steamboat lines and will handle a passenger traffic of approximately 200,000 people per month. Beezer Bros., Seattle, were the architects of the building. The dock is owned by the J. M. Colman Co. and is leased by the Colman Dock Co., of which latter corporation Mr. B. F. Morgan is manager.

"In the Merchant Service"

The Alroma had just cleared the dock and was getting under way for the open sea when one of the feed pumps showed signs of giving trouble. You know the usual first symptom,—the sort of indefinite hiccough, the the last being a violently rythmic kick in one of the legs. In this case the hiccough was most pronounced, an indefinite kick showing occasionally. This being the case the pump was shut down for examination, and the engineers off duty turned out to lend a hand. Through knowledge gained from past experience the tools considered necessary on a job of this kind were carried from the storeroom by the engineers on their way below, the idea being more to save time than save labor.

"We'll look at the valves in the first place," said the Third, as he arrived at the job. Engineers, by the way, will notice the originality of this remark; made, by the way, when the junior engineer on duty had most of the valve covers slackened away. The suction and delivery valves were lifted from their seats, carefully examined, the lift of the valves noted, and returned to their places. The trouble was not there.

"Aren't you going to examine the seats?" asked a junior making his second trip, his experience with a large ballast pump on the previous trip calling forth the suggestion.



"THERE'LL BE SOMETHING DOING NOW," CALLED THE STOREKEEPER AFTER THE RETREATING ENGINEER.

"Go ahead on the slide valve covers," said the Third, anxious to impress on the junior the fact that *he* was taking charge of the job. While the covers of the valve chests were coming off, the Third climbed the ladder for such other tools as might be necessary before the pump was again under way. The storekeeper was having dinner, and, considering the variety of tools already on the job,

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rather resented being compelled to return to the storeroom. He went below in silence, however, and passed out another Stilson wrench, hand hammer and a husky-looking pinch bar.

"There'll be something doing now," called the storekeeper after the retreating engineer. The Third was also missing his dinner and was in no frame of mind to welcome sarcasm from his inferiors, so he made a mental note of the matter as he strode to the head of the ladder.

The slide valve covers having been removed, the pistons were placed in position and valves examined. Everything there seemed to be all right.

"We'll box her up and give her steam," said the Third, remembering that he had not seen the pump in action and therefore could not very well diagnose the trouble. Examining a large feed pump on account of hitch in its action is a mighty long job, especially if one has not seen the pump in action and noted the hitch peculiar to the case. So the pump was again set away. It worked splendidly for about the space of one quarter of a minute, when the kick returned; so the pump was again shut down.

"The trouble is in the pistons," said the Second, now taking a hand in the game. The junior gingerly climbed on top of the pump and proceeded to remove the cylinder cover nuts, meanwhile broiling gently in an atmosphere of about 160 Fahr. When the covers were off, follower and piston rings examined, it developed that the Second was a poor guesser. Another consultation followed.

"I have examined the steam and water valves, buckets and pistons," said the Third, "and this job seems to have me beaten."

"Maybe the trouble is in the valve seats," ventured the junior, "I remember last trip, when the ballast pump was giving trouble, we found one of the seats—"

"Say," responded the Third, slowly and impressively, "this is no ballast pump. This is a feed pump, and it is fresh from an extensive overhaul in the repair shops. Lastly, this type of pump has solid seats."

"Never mind, Smith", said the Second, reassuringly, "your suggestion is made in good faith, and we all have lots to learn."

At this point the Third made the startling discovery that the set bolt used in holding the seat of the main delivery valve in place was loose. It was tightened up till the head abutted the valve chamber, at which point it did not seem to be gripping the seat. This being the case the junior went off to hunt a longer bolt. Not finding one a piece of brass studding was shaped, screwed firmly into the seat and made fast with a nut. Again the pump was started up and again the old trouble.

As the Chief was making thoughtful remarks down the speaking tube about the time being taken up on a trifling job like a feed pump overhaul things were certainly getting desperate. A rival steamer belonging to an opposition line was slowly but surely pulling away from the old Alroma.

"You're sure the slide valves are set right?" asked the anxious Second.

"Sure," responded the Third, "dead right."

"Buckets all right, too?" pursued the Second.

"Yes, tried 'em myself."

"You've tried the lift of the feed and suction valves, of course?"

"Of course," answered the Third.

"Tried everything else you know of, too," suggested the senior man.

"Everything."

"I remember when the ballast pump kicked last trip," chimed in the junior, "it just seemed—"

"Say," interrupted the annoyed Third, "If you mention that blessed ballast pump again I'll—"

"Hold on," broke in the Second in turn, "suppose we just have a look at these seats. You know that this pump was rushed aboard the ship at the last minute and only got a hurried test. It might be the case that new seats have actually been fitted to the chamber and one of them might be loose."

The suggestion was immediately acted upon, and once more the valve covers were lifted. New seats *had* been fitted to the chamber, and one of them *was* loose.

As the Third later climbed the ladder in search of something to say he noticed that the junior was following in his wake wearing one of these annoying I-told-you-so smiles.

THE "STAND BY" MAN.

REPAIR OF THE MAURETANIA.

The overhauling and repair of the Mauretania, now proceeding satisfactorily in the Canada graving dock at Liverpool, is so large an undertaking that, although several hundred men are engaged on the work, it cannot be completed before the end of the year. One of the most important branches of the work is that in connection with the propellers. Up to a few months ago the vessel was propelled by four three-bladed screws. Then she lost her forward port propeller by striking, it is supposed, submerged wreckage. A steel bracket, which weighs 27 tons, was also so much damaged that it was impossible to refit the screw at that time, so the Mauretania continued to run with three propellers. A new bracket was forged at Darlington, and preparations are now being made for fitting this in the place of the damaged bracket. The directors have also decided to have four-bladed propellers of solid type, each weighing, with boss, 18 tons, placed on the forward port and starboard shafts. This departure, which has already been effected in connection with the Lusitania with satisfactory results, will, it is anticipated, increase the speed of the Mauretania so that she will at least be able to cross the Atlantic in as quick time as her sister ship. The alteration will also, it is believed, prevent vibration. The three-bladed propellers which are being placed on the two after shafts weigh, with boss, 22 tons each. The Mauretania, having been in commission 12 months, is being thoroughly overhauled, and repairs to her hull are being carried out, including the replacing of some bow plates damaged some time ago during docking operations. The work is continued day and night, and no doubt is felt that the Mauretania will be ready to sail for New York on her scheduled date Jan. 2.

UPSON-WALTON CO.

The Upson-Walton Co., Cleveland, is putting out a series of catalogs in which the various departments of their extensive business are treated separately. Two catalogs have reached this office, one devoted to nautical instruments, and the other to anchors. The catalogs are clearly illustrated. Compasses, binnacles, bearing indicators, logs, peloruses, sounding machines, binoculars, parallel rulers, protractors and charts are described in the nautical instrument catalog which, while not large, contains a very excellent index. The anchor catalog gives the various types of anchors carried by the company which includes all the standard types of anchors in ordinary use. These catalogs will be sent to anyone interested.

Chief Engineer Cowle, of the Montreal Harbor Commission, in an address given in that city recently stated that to his belief the proposed Hudson Bay route for ships to Liverpool is both impracticable and unfeasible. The cost, the physical conditions and the resulting advantage, at best, he says, are inhibitive, the route being available for only a few weeks in the year. In his opinion the government would do better to open up the St. Lawrence route to Quebec for winter navigation.

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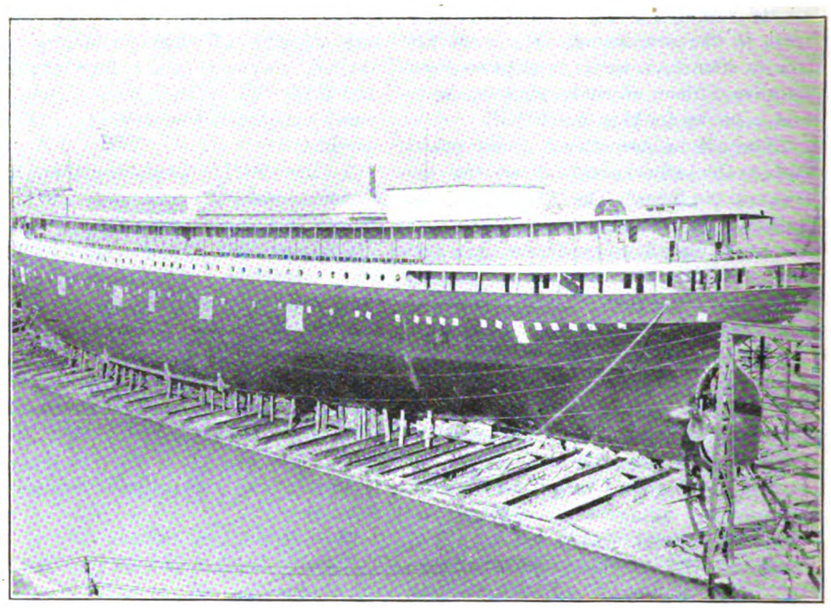
LAUNCH OF THE HAMONIC.

The Northern Navigation Co.'s new passenger steamer Hamonic was successfully launched at the yard of the Collingwood Ship Building Co., Collingwood, Ont., on Thanksgiving Day and was christened by Mrs. H. H. Gildersleeve, wife of the manager of the steamship company.

The Hamonic, when completed, will be one of the finest vessels engaged in the package freight and passenger trade on the great lakes. She is 365 ft. over all, 50 ft. beam, and 27 ft. molded depth to spar deck. She is built on the channel system, fitted with water bottom compartments, and is provided with nine water-tight bulkheads. She has seven gangways on each side, two for passengers and five for freight. Each freight gangway will serve two hatches. She has accommodations for 425 first-class passengers and 75 second-class, in addition to a crew of 100 persons. The Hamonic will engage in trade between Windsor, Sarnia, Sault Ste. Marie, Port Arthur, Fort William and Duluth, running in connection with the Grand Trunk Railway system in eastern Canada and the Grand Truck Pacific in western Canada. She is fitted with quadruple-expansion engines of over 6,000 H. P., steam being supplied by six double-ended Scotch boilers, allowed 250 lbs. working pressure and fitted with Howden draft. Her regular service speed will be about 16 miles an hour, though it is understood that she will be capable of traveling 21 miles an hour light. Her auxiliaries are quite complete, including a wireless telegraph outfit and a complete refrigerating plant installed by the Kroeschell Bros. Ice Machine Co., of Chicago.



THE HAMONIC ON THE WAYS.

STEAMER NORTH STAR SUNK.

The package freighter North Star of the Mutual Transit Co.'s fleet was sunk in 90 ft. of water off Port Sanilac, Lake Huron, in collision with her sister ship Northern Queen. The North Star was bound down with a full cargo of wheat, flour and shingles, and the Northern Queen was bound up with a general cargo of merchandise. The collision occurred about 5 o'clock on the morning of Nov. 25 and was due to a fog so dense that neither vessel saw the other until it was impossible to avoid the collision. The North Star was struck on the starboard bow abreast of the pilot house and sank almost immediately, the crew barely having time to escape in the small boats. They were picked up by the Northern Queen and taken to Port Huron where they were transferred to the Northern Light. The bow of the Northern Queen was badly damaged. Neither Capt. Cartwright of the North Star nor Capt. Stevenson of the Northern Queen made any statement other than that the collision was wholly due to the dense fog prevailing. The North Star was insured for $120,000. As she carried a valuable cargo, the total loss will be nearly $250,000, which is one of the heaviest losses that the underwriters have had to sustain this season.

The North Star was one of six steamers built by the Globe Iron Works of Cleveland for the Northern Steamship Co. of Buffalo. They were purchased by the Mutual Transit Co. some years ago.

LAUNCHING OF THE HAMONIC.

PIG IRON SITUATION.

While several fairly good sized orders for pig iron have been closed, yet in most centers inquiries are not numerous and sales are light; however, quotations are well maintained. Buying of steel cars in large numbers by numerous railroad interests has given reason to the belief that the placing of contracts for equipment will soon be an important feature of the market. The bar iron market is in a rather unsatisfactory condition, since prices of

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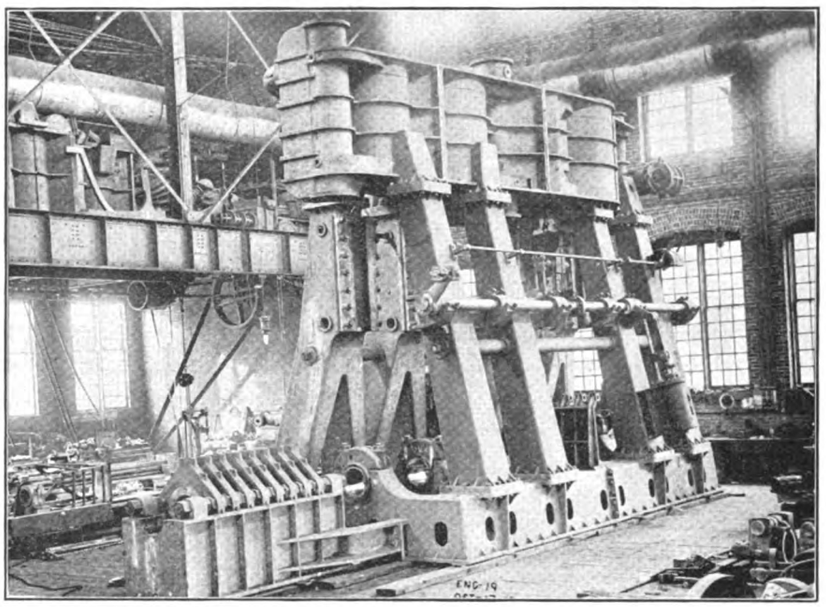
scrap are so high that bar can not be sold at regular quotations. There has been no general advance in bar iron prices, and the prevailing sentiment among steel bar makers is opposed to higher prices. A number of important building contracts in various parts of the country are under consideration, but the actual tonnage placed the past week has been light. There is limited contracting for coke, and the tendency of old material prices in most large business centers is upward.

KEEFE AS COMMISSIONER OF IMMIGRATION.

Daniel J. Keefe, president of the International Longshoremen's Association, has been appointed commissioner general of immigration by President Roosevelt. Mr. Keefe as a labor leader is well known on the lakes, and has been successful in handling large bodies of men because he has been uniformly fair in his dealings with both sides. During the recent political campaign he was an outspoken supporter of Judge Taft and was the only member of the executive council of the American Federation of Labor who opposed the Gompers plan of supporting Bryan.

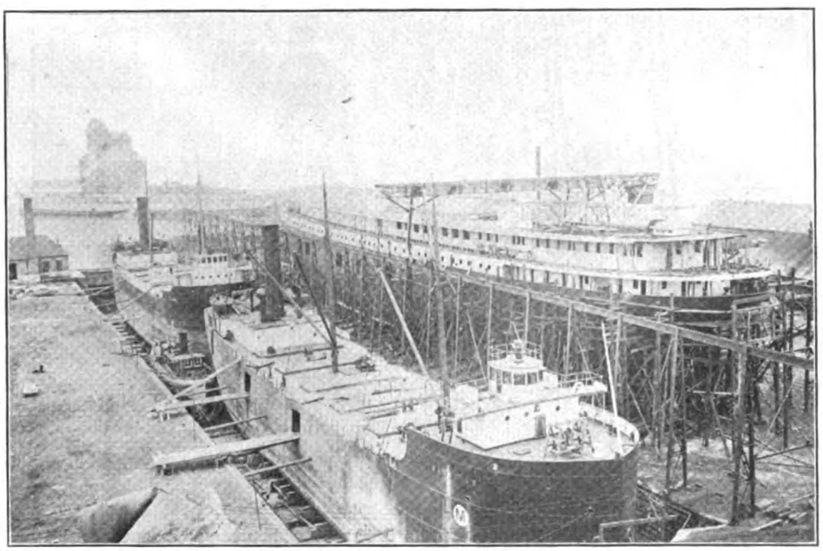
SENECA CHAIN CO.

The Seneca Chain Co., Kent, O., has just issued a circular containing information on Stub Link Chains which they make in all sizes from ⅜ to 3½ in. These chains are tested with testing machines that have been approved and licensed by Lloyds, American Bureau of Shipping, Bureau Veritas, Bu the American Ship Masters' Associa-



ENGINE OF THE HAMONIC IN COURSE OF CONSTRUCTION IN THE MACHINE SHOP.

tion. It is the company's custom to cut sections from all cables after the chain-makers have left the shops, pulling such pieces to destruction in order to determine the quality of work that is being turned out each day. In making a breaking test recently of a piece of 2-in. Standard Stud cable, the section parted at a strain of 256,819 lbs., elongating 21½ per cent before fracturing and withstanding a strain of 216,619 lbs. before elongating, and a pull of 254,510 lbs. before showing any skin fractures. The cables are built in such a manner as to make the weld end of the links the strongest part of the chain. Operating 249 chain fires at Kent and Mansfield, and employing 700 men, the company has facilities to take care of the largest orders promptly.



THE WELLAND CANAL STEAMERS CANADIAN AND CROWE IN DRY DOCK AT THE COLLINGWOOD YARD.

The Newport News Ship Building & Dry Dock Co., Newport News, Va., is to build a steel freight steamship for the A. H. Bull Steamship Co., of New York, at a cost of $300,000. The new steamer is to be 320 ft. in length, 46 ft. beam and 24 ft. deep, and is to be completed in nine months. Work is to be started upon her at once.

It is regarded as probable that another steamer of the stern-wheel type will be built at Victoria, B. C., this winter for the Grand Trunk Pacific Railroad Co., to be used in conjunction with the steamer Distributor. The contract for the machinery is likely to go east, the machinery of the Distributor having been built by the Polson Iron Works, at Toronto, and placed in the hull built by Alex. Watson, at Victoria.

Percy & Small, Bath, Me., launched the largest wooden schooner in the world, the six-master Edward B. Winslow, Nov. 24. This vessel was built at a cost of $175,000 for the J. S. Winslow Co., of Portland, Me., and is 318.3 ft. in length, 50 ft. beam and 29 ft. deep, and registers 3,424 gross tons. She was launched ready for sea and sailed shortly afterward for a southern coal port.

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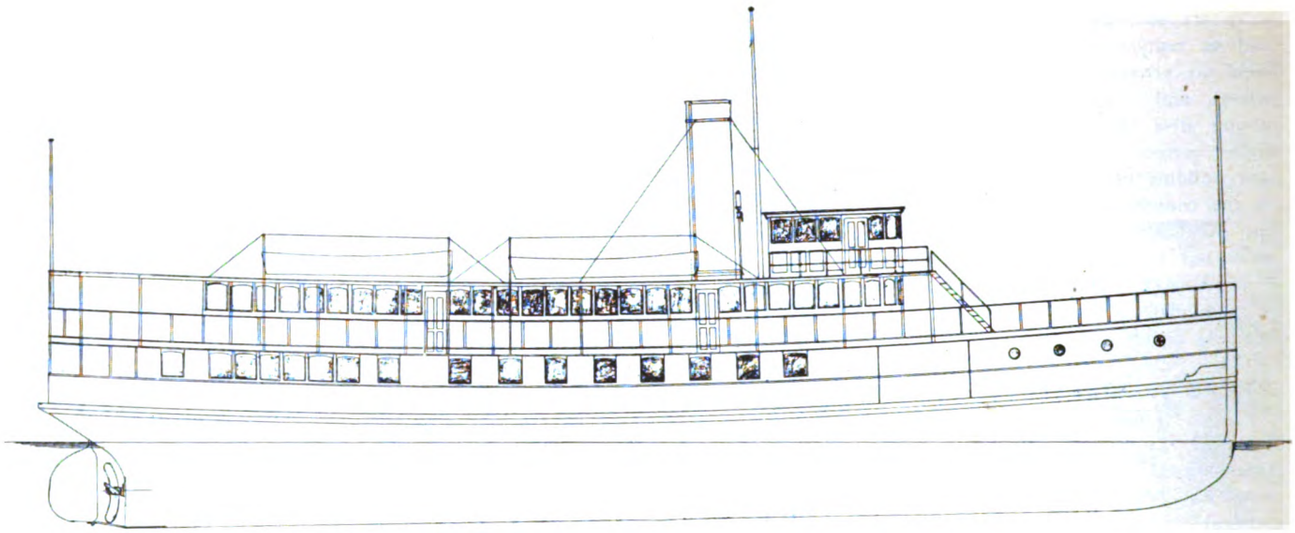

OUTBOUND PROFILE OF PASSENGER STEAMER VASHONIAN FOR THE VASHON STEAMBOAT CO. BUILT BY PHILIP D. SLOAN, SEATTLE, WASH.

PUGET SOUND STEAMER VASHONIAN.

The newest wooden passenger steamer on Puget Sound is the Vashonian, which was launched the first week in December. The Vashonian was designed and built by Philip D. Sloan, ship builder, Seattle, for the Vashon Steamboat Co., also of Seattle. When completed she will operate between Seattle and points on Vashon Island, which is situated between Tacoma and Seattle. She is a strictly daylight steamer designed for fast service on short runs on the inland waters of Puget Sound. She required 90 days to build and cost $40,000.

The hull shows clean, substantial lines, with a full rounded stern which indicates reasonable speed coupled with more than average ability to weather heavy seas. She is 125 ft. long over all, 22 ft. molded beam and 8 ft. molded depth. The frames and planking are of fir. The main keelson is 10 x 12 in.; the sister keelson 7 x 14 in., the bilge keelsons 4 x 8 in. and the boiler and engine keelsons 10 x 20 in., 74 ft. long. The ribs are 12 x 12 in. at the keel and 6 x 6 in. at the head, spaced 21 in. between centers. All frames are fastened with button headed bolts and nuts and washers. The planking is 2½ in. net thickness and the ceiling 2 in. net.

The Vashonian will burn coal and has a bunker capacity of 20 tons. She is provided with two independent water tube boilers built by the Almy Water Tube Boiler Co., Providence, R. I. The boilers will carry 250 pounds per sq. in. pressure.

The engine is triple expansion, 12¾-

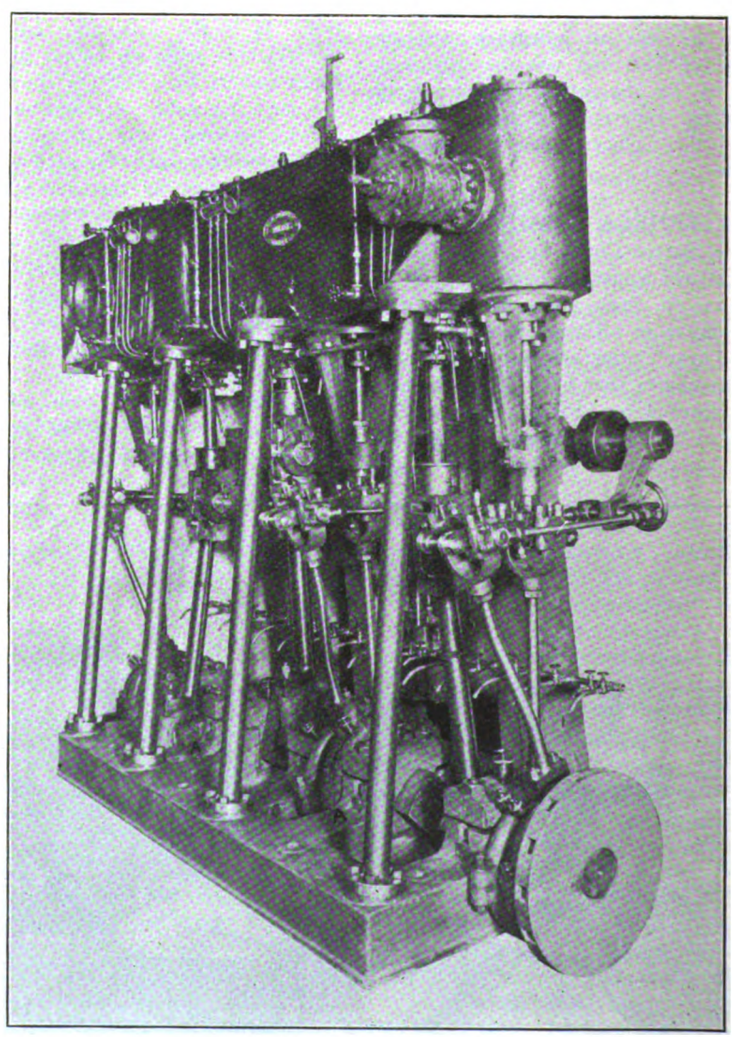

FIG. 1—TRIPLE-EXPANSION ENGINE OF 700 H. P. FOR STEAMER VASHONIAN. DESIGNED AND BUILT BY NORTHWESTERN IRON WORKS, SEATTLE, WASH.

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NEL.

20 and 33 x 16 in. stroke shows through a 6⅜ in. steel tail sh oit rive 82-in. propeller with 110 in. p comple engine is designed to run at 25 he Great but will probably be operated Unusual P. M. The engine was desi onstruc constructed by the Northwest ons, and Works, Seattle. ig com

An interesting feature of th is the method of fastening the the main bearings. This is shown in the accompanying ph Fig. 1. The bed is cast flat cap bolts instead of going clear have their lower heads fitted in shown at "A" on the photogra

Some of the details of the en as follows: Size of main 67/16 in. diameter by 10 and 12 The ratio of the crank radius connecting rod length is one t a more liberal proportion than i on most small marine engines. able piston valves with a trav in. are fitted to the high press intermediate cylinders, while th pressure cylinder has a balanced ported slide valve. Ordinary S son link motion reverse gear provided with independent cut the three cylinders. The engine signed to cut off at ¾ stroke working in full gear. The li operated by steam. A complete r automatic oiling system is provid thrust bearing is of the horsesh The engine is designed to indic H. P. at 250 R. P. M., w pounds boiler pressure.

A surface condenser 7 ft. lon in. in diameter, fitted with 50 brass tubes is provided. The c is provided with a 5 x 5 in. cer circulating pump and an ind duplex 8 in. x 12 in. stroke B pump. The boiler feed pump x 4½ in. x 8 in. stroke, outside plunger pattern. In addition th 6 in. 4 in. x 6 in. stroke, fi and auxiliary boiler feed pump.

The cabin finish will be in and neat. The cabin is furnis opera chairs and the longitudi are upholstered in plush. The c no partitions, but is open from end. Electric lights are used out. The Vashonian will have rying capacity of 350 pasenger speed of 17 miles per hour.

The steamer Washington, Norfolk & Washington St line, ran down and sank the f Lackawanna in the Potomac r week. One of the ferry's pa is believed to have been dro

ER TUNNEL AT THE ST. CLAIR PLANT OF THE KES ENGINEERING WORKS.

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e. Ma shing a recently sit the nts. It favor nal on

government property, so located in relation to the rapids that the dock could be filled and emptied without pumping.

The Canadian marine department has been given the use of the United States government's derrick scow at Amherstburg and the work of removing all of the bowlders at the docks there is under way. The entire water front will be swept and a depth of 21 ft. will be secured along the harbor. This improvement will enable deep draught vessels to fuel at Amherstburg as well as eliminating a menace to navigation.

The steamer Sierra, coal laden, had a severe experience in crossing Lake Superior on her last trip. The windows of the pilot house and captain's quarters were crushed in while ice formed rapidly on the forecastle deck.

Evidently the Lake Erie Excursion Co., which built the steamer Americana to operate between Buffalo and Crystal Beach, had a successful year. The company has just declared a dividend of 8 per cent.

The Detroit lighting commission has awarded contract to the Great Lakes Dredge & Dock Co. for the construction of a concrete wharf at their plant on the Detroit river. This will be the first concrete dock to be built in Detroit.

Under the direction of Lieut. Col. Fitch, John H. Darling, assistant United States engineer at Duluth, measured the action of waves at different points along the wharves and in the anchorage ground of the harbor basin at Duluth and found that with a northeast wind blowing at the rate of from 40 to 50 miles an hour, waves 7 ft. high are produced in the harbor. Mr. Darling found that the new cribs that are being put in at Rice's Point were badly damaged by wave action and that the freighter L. C. Waldo, loaded with coal, was rising and falling about 2 ft. in the harbor basin.

The board of commerce of Lorain called upon Congressman Burton and Lieut. Col. Millis, government engineer at Cleveland, last week in relation to improving Lorain harbor. There is about $125,000 remaining in the appropriation fund and this will be used to connect the west breakwater with the shore. The board of commerce also desires an extension of the east breakwater eastward.

FINANCE IS TOTAL LOSS.

The Panama Railroad Co.'s steamer Finance, which was sunk by the White Star liner Georgic in New York Bay on Thanksgiving day, has been pronounced a total loss.

Insurance on the fleet of the railroad company, which operates the line of steamers between New York and the canal zone, was discontinued last July and the government took upon itself all responsibility for loss, as the Panama Railroad Co. is in reality a government concern, its stock being owned by the government and its officers and directors being government officials. Unless the government is able to recover the loss from the White Star line, it will likely take from the canal appropriation moneys to reimburse itself for the loss suffered in another department.

It has been reported that when the Georgic struck the Finance some one on the Georgic made the mistake of letting go the anchor before her bow was clear of the hole cut in the Finance. In consequence of this mistake the anchor dropped in the hole in the Finance's side, and as the Georgic fell away the fluke of the anchor caught and tore out some of the sinking steamer's plates. It had been reported to the officials of the Panama line, though they refuse to discuss it, that Capt. Clark was heard to say that his vessel refused to answer her helm, and that she was too light to be easily handled.

The total loss by the collision has been cut down by $115,000 by the recovery of $100,000 in gold shipped by the Panama canal commission to pay off its employes as well as other valuables contained in the strong room of the sunken vessel. The purser's department still contains the valuables committed to his charge.

The passengers on the Finance were at once transferred to the steamer Orinoco of the same line and before sailing were supplied with clothing by the government.

The Finance was valued at $250,000, and her cargo at a like figure.

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ATLANTIC COAST NOTES.

Office of the MARINE REVIEW,
Room 1005, No. 90 West St.,
New York City.

"Sandy Hook Lightship Abeam" has been entered in the logs of incoming and outgoing craft for the last time. On Monday the famous old lightship officially ceased to exist and vessels passing the new station will in future enter "Ambrose Channel Lightship Abeam" in the log sheet.

While groping her way through the dense fog which blanketed the lower bay last Thursday the steamship Finance, of the Panama Railroad Steamship line, collided with and was sunk by the steamship Georgic, of the White Star line, while the Georgic was passing in on her first trip to the United States since the business depression. Three of the passengers of the Finance were drowned, and William H. Todd, the third assistant engineer. The Finance was rammed abaft of amidships and sank almost immediately, the passengers jumping overboard to be picked up by the boats of the two vessels. The Georgic carried the survivors to port. The accident was caused by a misunderstanding in signals, and will be investigated by the steamboat inspection service.

The record fog which enveloped the harbors and coasts during the past week was accountable for many minor accidents, the accident to the Finance being happily the only one of its class. The Naugatuck, of the Bridgeport line, rammed the Pequonnock, of the New England line, at the north end of Hell Gate, while the latter vessel was at anchor waiting for a lift in the fog. Part of her stern was carried away, but the damage was not serious. The harbor ferryboats Scandinavia and Wilkesbarre, of the Lackawanna and Central railroads, respectively, collided as the Scandinavia was entering her Hoboken slip, several minor accidents of this class occurring.

The Atlantic, Gulf & West Indies Steamship Co. has been incorporated in Maine, the design of the company being to take over the property of the Consolidated Steamship lines according to the reorganization plan perfected some time ago. The property of the Consolidated Steamship lines included all the stock of the Eastern, Metropolitan, Mallory, Clyde, New York and Cuba Mail and New York and Porto Rico steamship companies. The incorporators are H. R. Mallory, H. P. Booth and James R. Nicol, of New York, and Henry Hornblower and Galen L. Stone, of Boston, all of whom are members of the reorganization committee. H. R. Mallory is president and James R. Nicol treasurer.

The John S. Bennett, a British bark, arrived at Sandy Hook this week and on dropping anchor at Quarantine reported needing the services of a surgeon. It developed that the master of the vessel, Captain Firth, while engaged in taking observations on Nov. 2 from the yards, lost his balance and fell a distance of 65 ft. to the deck. The rigging broke his fall and his injuries, though painful, were not serious.

The large number of prepaid return tickets recently sold to outgoing third class passengers is another of the sure signs of increasing prosperity. The rush to the Mediterranean this winter by both cabin and steerage promises to exceed all previous travel in that direction.

The oil exports from the port of Philadelphia for the past week amounted to 8,000,000 gallons, this amount being a gain over the same time last year of over 2,000,000.

Mariners are requested that, in notifying the derelict destroyer Seneca, stationed at Tompkinsville, S. I., N. Y., of the sighting of any wreck, in addition to giving the date and location of latitude and longitude, to give the force and direction of wind and sea, with the probable drift of the derelict.

Dismasted and with decks awash, the derelict schooner John M. Brown, which was abandoned by her crew on Oct. 30, was sighted on Nov. 1, in latitude 37.50, longitude 59.15, by the British steamer Haverstoe, which arrived at New York on Nov. 27 from Java. The abandoned barge Edgewater, which broke adrift at sea, while in tow from Guttenberg, N. J., for Boston, has been sighted and reported by several incoming steamers. The crew of the Edgewater were picked up by the Norwegian steamship Wegadesk, from Philadelphia.

The largest wooden schooner in the world, the six-masted Edward B. Winslow, was launched from the yard of Percy & Small, Bath, Me., last week. The vessel was built for the J. S. Winslow Co., of Portland, Me., and is 318.3 ft. in length, 50 ft. beam, and 29 ft. deep. She has a gross tonnage of 3,424 and cost $175,000 to build. She is commanded by Captain Henry Butler, of Phillipsburg, Me.

The schooner Jennie Thomas, of Savannah, Ga., has been abandoned, waterlogged, 400 miles east of the Virginia Capes. The captain and crew of six men had struggled with adverse conditions on the leaking vessel for almost a month, and when hope was almost abandoned were taken off of the vessel by the steamer Afghanistan, from the Mediterranean. When picked up the crew were in a destitute condition and had no boat in which to leave the wrecked vessel. The Jennie Thomas is floating a dangerous derelict supported by her cargo of lumber.

The steamship Admiral Sampson, owned by the American Mail Steamship Co., has been sold for use on the Pacific coast between San Francisco and Seattle. The Sampson will be fitted out for her extended voyage immediately and will sail in connection with the Watson and Buckman, sold some time ago and now trading in the Pacific. The Sampson was built by the Cramp company in 1898, and has since been engaged in the Jamaica fruit trade.

There arrived at San Juan, P. R., last week six sailors and the master of the American schooner John M. Brown, which foundered at sea on Oct. 30. The vessel left Brunswick, Ga., Oct. 15, with a cargo of lumber, and encountered heavy weather during which she was supposed to have struck some submerged wreckage. She leaked badly and it was decided that it was impossible to save her. The crew launched a naphtha launch carried on the vessel and with a quantity of provisions pushed away from the Brown, which sank a few minutes later. The men were picked up five days later by the American schooner Brookline, from Philadelphia, and taken into Arroyo.

The lighthouse department has been notified of the safe arrival of the flotilla of three steam lightships and three lighthouse tenders, which sailed from Tompkinsville, S. I., Sept. 21, for Pacific service at Punta Aronas, Straits of Magellan, last week.

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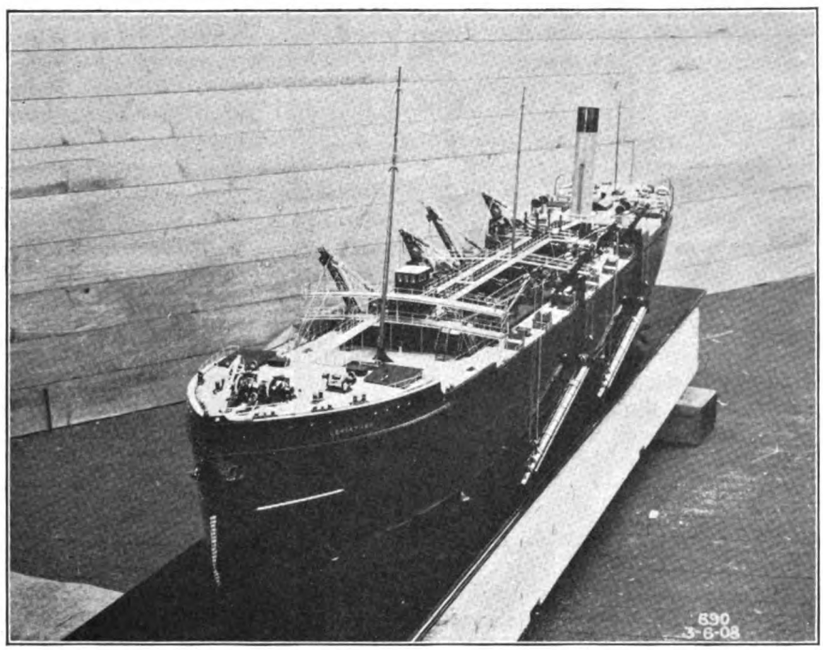
A UNIQUE BRITISH DREDGER.

The dredging of the river Mersey has in consequence of the ever-increasing size of Atlantic liners become a very serious problem to the port authorities of Liverpool. Notwithstanding that no less than 121,424,470 tons of sand have been dredged from the bar and the channels of the Mersey since 1890, and that the largest and most up-to-date suction dredges have been employed in this work, the silting goes on, and the minimum depth of 28 ft. at low water spring tides is with difficulty maintained year after year. It has become so serious that one of the main channels, near what is known as Askewspit, is being considerably narrowed by silting, and unless an effort of an extraordinary character is made to increase the scour in this vicinity, coupled with more aggressive work in dredging, the navigation of this main channel will become very dangerous indeed to the larger type of Atlantic liners. It is to remedy this state of things that a revetment wall is to be laid down on the opposite bank to increase the scour near Askewspit by directing the current in that direction, and with a view to additional dredging being undertaken, the Mersey Docks and Harbor Board has had built a new suction dredge, capable of lifting 10,000 tons of sand in 50 minutes, which makes this craft easily the largest of her class in the world. This vessel, which has been named the Leviathan, was launched on Oct. 24 by Messrs. Cammell, Laird & Co., ship builders, of Birkenhead, and our illustration is from a photograph of the model of this dredge exhibited at the British-Franco exhibition in London. The following particulars are supplied by the builders:



MODEL OF BRITISH DREDGE LEVIATHAN.

The Leviathan is built of steel, and has twin screws. Her dimensions are: Length, 487 ft. over all; beam, 60 ft.; and depth, 30 ft. 7 in.; these large dimensions being necessary to give her the capacity and strength to carry her enormous load of 10,000 tons of sand. She is to be provided with pumps capable of dredging this load in 50 minutes from a maximum depth of 70 ft., and her propelling machinery is to be capable of driving her, when fully loaded, at the rate of 10 knots. She is designed to carry her full load of sand as well as bunker coal and fresh water on a mean draught of 23 ft. The vessel is built of steel to class 100 A1 at Lloyds. She has a complete steel upper deck sheathed with wood, and is divided transversely by 13 watertight bulkheads extending from keel to deck. A longitudinal center line bulkhead divides the hoppers, pump rooms and boiler rooms, as well as No. 2 buoyancy spaces on each side of the vessel. These subdivisions, taken in conjunction with the watertight hopper side bulkheads, divide the vessel into about 30 separate watertight compartments. The steel hull structure has been arranged to give special strength to the vessel in view of the great strains developed in loading and unloading her hoppers.

The propelling machinery will be placed aft, and consists of two sets of inverted vertical triple-expansion engines, each having cylinders 22½ in., 37 in., and 61 in., by 45-in. stroke. Steam will be supplied by four large single-ended boilers, placed between the propelling and pumping engine rooms, and constructed for a working pressure of 180 lb. per square inch. Watertight doors controlled from the upper deck are fitted in machinery space bulkheads for access from one room to another. The hoppers are situated forward of the pumping engine rooms, and built in 12 separate compartments, six on each side of the center line bulkhead. The side compartments adjacent to the hoppers, as well as the two forward holds, are buoyancy spaces rendered necessary for the vessel to support her weight of hull, plant, and load on the specified draught of water. The dredging plant consists of four sets of inverted triple-expansion engines, coupled direct to four centrifugal pumps connected to their respective suction tubes, two on each side of the vessel, with hydraulic sluice valves on the inboard side. Each tube is 42 in. internal diameter, 90 ft. long, and bolted to a heavy cast steel swivel bend at the upper end and a strong nozzle of special form at the lower end. The latter is fitted with a cast steel grid to exclude material of such a size as would choke the pump. The swivel bends work in vertical slide frames riveted to the vessel's sides with trunnions to allow the suction pipes to hinge about its center, and thus be raised or lowered to suit the state of the tide while dredging. The suction pipes have 45 degrees inclination when dredging at their lowest limit of 70 ft. below sea level. Each suction tube is lifted and lowered by two strongly built derricks of steel, one on each end of the tube and stopped on seats at upper deck, and complete with blocks and flexible steel wire ropes led on to drums of its respective hoisting winch. Deck slides supported by strongly built seats on deck are fitted over each slide frame to enable the suction pipes with swivel bend to be stowed inboard when not dredging. Each deck slide has a heavy cast iron frame of the same section as the slide frame, and can move inboard or outboard by worm

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gear. This is carefully adjusted, so that it comes exactly in the same vertical plane as the slide frame when at its extreme outboard position, to allow the suction pipe to be lowered to its working position below water level.

Each suction tube is provided with emergency gear, so that in case of accident the suction tubes may be lifted by blocks and tackle led to the deck winches. Two of these winches are fitted under the forecastle deck and two on the poop deck. The four hoisting winches are enclosed in steel houses with glass fronts, the latter being provided so that the winchman can control and have a complete view of the derrick lifting and lowering gear. Each hoisting winch has four drums arranged in pairs, two for raising and lowering the suction pipes and the other two for derricking in or outboard. These powerful winches are actuated by double cylinder reversing steam engines.

The four dredging pumps are arranged to deliver along pipes passing up through the deck into two landers, and fitted with hydraulic sluice valves where they join the same. The landers are built side by side with a center division, and run the full length of the hoppers.

Two lander valves worked by worm gear are fitted over each hopper on the bottom of the landers, so that the discharge of any hopper can be controlled as desired. By these means the valves with control gear are also arranged in the steel division separating the two landers. The discharge of sand and water from any or all of the pumps can be controlled so as to trim the vessel as necessary. Flushing pipes—with valves controlled from fore and aft gangways—are led from the lower sides of the landers for flushing each hopper when discharging the load.

Each of the 12 hoppers are fitted with Lyster's patent valves, having an opening 5 ft. 6 in. diameter through the bottom of the vessel. The hopper bottom plating has a steep slope in the four directions down to the edges of the valve seat bottom casting for the quick discharge of sand. Each valve is of a tapered cylindrical form, extending the full depth of the hopper, with an open bottomed valve at the lower edge, and having a lift of 4 ft. These valves are worked by hydraulic cylinders, controlled from fore and aft gangways, and supported by a continuous fore and aft girder running the full length of the hoppers and above them. Guide rings efficiently stayed to hopper sides are fitted at the upper and lower parts of the valves for steadying them. A surface valve, with a lever for opening or closing it from the gangways, is fitted on the top of each hopper valve to drain off the surface water. During dredging operations the mixture of sand and water is delivered into the landers, and thence falls into the hoppers through the valves already mentioned. The sand settles in the hoppers, while the surface water runs aft along a waterway formed of the hopper coamings to weir plates, which can be adjusted to suit the trim of the ship, and thence overboard through large rectangular shoots, two on each side. When discharging spoil, the hopper valves are raised and the sand falls rapidly through the openings in the bottom of the vessel.

An indicator is fitted up in the chart room to show the draught of the vessel, as well as a complete system of repeating telegraphs and voice pipes for giving orders to the propelling and pumping engine rooms, and to the different winchmen.

Powerful electric alarm bells are also fitted at the pipemen's position. Pushes are fitted for each pipeman and one on the navigating bridge, so as to give alarm in case of necessity.

The hydraulic installation is provided by the builders, and consists of a set of three cylinder inverted high pressure direct-acting engines, having three cranks and three single acting ram pumps driven direct from the piston rod crossheads. The hydraulic pressure is 800 lbs. per square inch, and is used for working the four main sluice valves on suction pipes at sides of vessel, and those on delivery pipes at ends of landers, as well as for opening and closing the 12 hopper discharge valves. The vessel is fitted throughout by the builders with a complete installation of electric lights on the incandescent system. The engines and dynamo are placed in propelling engine room, the engine being of the enclosed type, compound direct double acting and coupled direct to the dynamo.

Two powerful steam windlasses of Harfield's make, each driven by separate vertical engines and connected by compound positive clutches at both the crank and main shafts, are to be fitted on the forecastle head for working the anchors.

The steam steering engine of Caldwell's make is placed in the engine casing, and is of the combined steam and hand type, which control shafting to the steering standard on the navigating bridge. Hand screw steering gear of Hastie's make is fitted aft immediately over the rudder head for use in case of the steam gear breaking down. A motor launch is fitted on the starboard side under Welin patent bow davits for ready use when sounding or taking observations.

The vessel has been superintended during construction by the staff of the engineer-in-chief for the Mersey Docks and Harbor Board (Mr. A. G. Lyster, M. Inst. C. E.), as well as Lloyds' surveyors.

AGREEMENT WITH SHIP YARD WORKERS.

Another step toward the much-to-be-desired industrial peace in ship yards of Great Britain was taken at the conference between the executive board of the Ship Building Employers' Federation and representatives of the ship yards trades unions on Oct. 28. The result of this meeting was an agreement of a provisional nature, by which it is hoped that both sectional and general strikes may be avoided in the future.

Representatives were present from every ship building center in England and Scotland and there were nearly 30 representatives of the trades unions in attendance. The official report given out concerning the proceedings of the conference contains the following:

"The agreement provisionally arranged is to be referred to the executives of the unions, with a view to a vote of their members, and to the various employers' associations connected with the Ship Building Employers' Federation.

"If the agreement is adopted, it is felt that it will prove a means of avoiding disputes and friction in the future."

The details of the agreement are not to be made public until the different societies affected have had an opportunity to take action upon it, but it is believed that the scheme provides that, should the settlement of a dispute fail in local hands, it is to go to a central conference of representatives of both employers and men, and that if they in turn fail to agree, a final grand conference of representatives of the general body of employers and ship yard trades unions shall be called.

It is with much gratitude that those connected with the ship building industry in England and Scotland are receiving this innovation, for nowhere has the strike evil grown to greater proportions than in this particular field.

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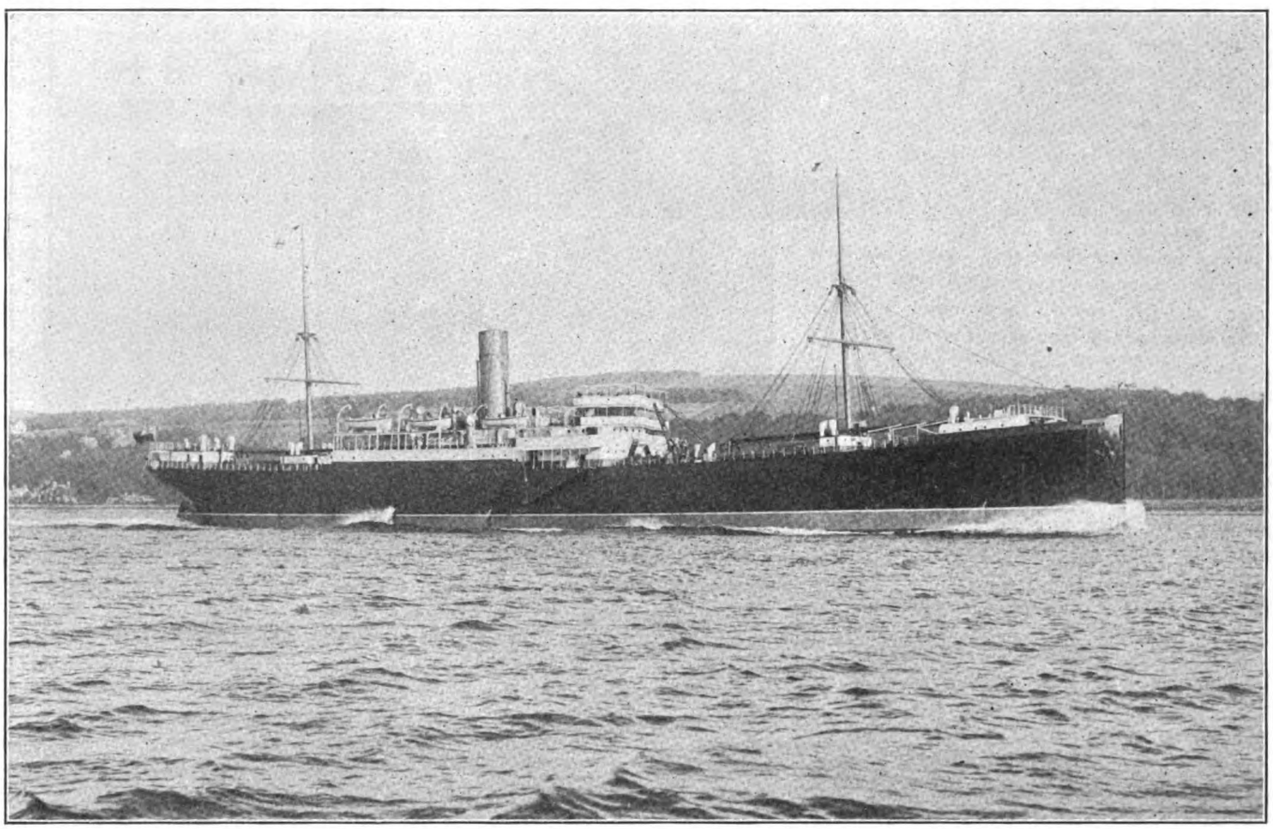
SUCCESSFUL TRIALS OF THE OTAKI.

The official trials of the turbine combination steamer Otaki, built for the New Zealand Shipping Co. by Messrs. Denny Bros. & Co., of Dumbarton, Scotland, have recently been run to the complete satisfaction of both builders and owners. The Otaki is the first merchant vessel fitted with the combination of reciprocating and turbine machinery, and in this vessel the attempt has successfully been made to obtain greater efficiency by adding a turbine with separate screw to the usual reciprocating engine equipment. It has been generally recognized that if the screws of a vessel are to be driven directly by turbines in cargo vessels or vessels of moderate speed, such as the Otaki, it was commercially impracticable to have a complete outfit of turbines. Therefore, the Otaki has been fitted with two sets of reciprocating engines driving twin screws fitted in the ordinary fashion, but between these two engines is fitted a low pressure turbine of very large size. The steam, after having done its work in the reciprocating engines, instead of entering the condenser directly, is passed through the low-pressure turbine which drives a center screw. This turbine revolves only in one direction, the turbine screw being used only for ahead propulsion. Change valves are fitted so that the steam may be either passed directly into the condenser or to the low pressure turbines. Hence, in maneuvering, the vessel becomes an ordinary twin-screw, the center screw taking no part only when going ahead. The twin-screw engines are triple-expansion of the ordinary type, having cylinders 24½, 39, and 58 in. by 39-in. stroke. The Otaki is virtually a sister ship to the Orari, which was built and delivered in 1906 to the same company, and when Messrs. Denny were consulted about the building of another vessel, they suggested to the owners the desirability of making an experiment with the combined engine. The owners, with their characteristic go-aheadness, agreed to the experiment. The only stipulations they made were that the builders should give them a reasonable guarantee as to efficiency, and that the capacity of the vessel should not be reduced. The boiler installation was to be precisely the same as in the Orari, the only alteration therefore that was made by the builders being that the length was slightly increased in the Otaki to make up for the loss due to the three tunnels, as against two in the Orari, and the stern post was so arranged that the third screw could be fitted in an aperture. The dimensions of the Otaki are 464 ft. 6 in. by 60 ft. by 34 ft., 4 ft. 6 in. longer than the Orari. On the completion of the builders it was found that the average mean speed of the Otaki was 15.02 knots, while the average speed of the Orari under similar conditions was 14.6. Since then the owners' official trials have taken place, the results being in every way confirmed with the exception that the speed developed was greater, being 15.09 instead of 15.02. As the boiler installation is precisely the same, this gives an excellent idea as to the increased efficiency of the machinery. The builders express themselves as highly satisfied with the result, and anticipate that the improved efficiency shown on trial will be maintained during the sea work of the vessel. As this vessel's trade is between Great Britain and New Zealand, a voyage of practically 13,000 miles each way, there will be an excellent opportunity for proving the



THE OTAKI, THE FIRST MERCHANT VESSEL FITTED WITH THE COMBINATION OF RECIPROCATING AND TURBINE MACHINERY.

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advantages of this system. It is also believed that the working of the two types of engines in combination will effect a saving of fuel to the extent of something like 10 per cent.

Mr. James Denny, of the builder's firm, speaking at the luncheon which took place on board the Otaki at the official trials, said that the result of the trials was quite up to their expectations. Basing on trial trip results, they found that the speed of the Otaki was about half a knot greater than that of her sister ship, on a lower water consumption, which, of course, meant a lower coal consumption. Horsepower in this combination was not quite the best measure of useful work, but, assuming that the sister ships had been driven at the same speed on trials as the Otaki, and basing on the indicated horsepower resulting from this, and applying this horsepower to the Otaki for her trial-trip speed, they found that the water per horsepower for all purpose was 12.3 lb.—a result which, it was believed, had not yet been attained by any other marine engine. They gave this result with a certain amount of reserve, as it was based only on the trial-trip data of this one vessel, and they awaited confirmation in actual service at sea. The economy of the Otaki had no doubt been helped by the system of condenser which had been fitted and which had enabled a high vacuum to be steadily maintained. This condenser was of the "Contraflo" type, from the designs of Mr. D. B. Morison.

THE THAMES CONSERVANCY MOTOR LAUNCH THAMES.

For some time past the Thames Conservators have found the small motor launch of considerable assistance to them in their duties, and the experience gained with the boat Thames delivered by Messrs. Thornycroft in the late summer has demonstrated the advantages to be derived from the use of larger craft of this description.

This launch is 45 ft. long by 8 ft. beam and 2 ft. 7 in. draught. She is carvel built of mahogany, with frames of American elm decks, of Kauri pine, stem and sternpost of English oak, and keel of American elm.

The whole of the scantlings are of sufficient strength for sea or river use as the launch is intended for patroling the Thames from Oxford down to the mouth. A cabin is fitted aft which contains W. C. and wash basin, pantry with shelves and sink, saloon with table, lockers, etc.

The boat is provided with a folding canvas hood forward and canvas awning over after well, the motor being protected by a mahogany casing with hinged panels.

The motor has 6 cylinders, each with a diameter of 4½ in. and a stroke of 5 in., developing 45 B. H. P. at about 1,000 R. P. M. The cylinders are of close-grained cast iron and water-jacketed, the circulating water being provided by a pump of the rotary gear type.

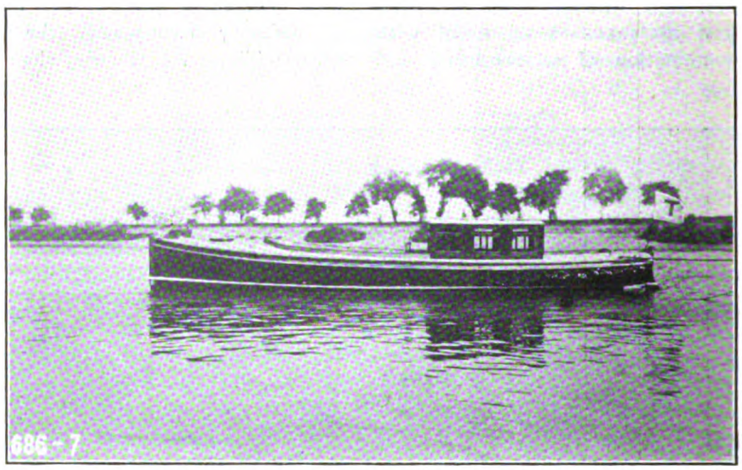
Lubrication is forced by means of a pump. A reversing gear is fitted of the Thornycroft type in conjunction with a solid propeller.

The photograph shows the launch on the Thames running her trials, when she accomplished a speed of 12 miles per hour.

THORNYCROFT MOTOR LAUNCH BUTTERFLY.

This launch, which is of a very staunch and serviceable type, is intended for cruising in the Bay of Smyrna.

She is carvel built of teak, with American elm timbers, 35 ft. long by 7 ft. beam, and with a draught of 2 ft. 3 in. Her machinery consists of a Thornycroft M4 engine and reversing gear. This engine has four cylinders,



THORNYCROFT MOTOR BOAT THAMES.

each 4½ in. by 5 in. and easily develops her guaranteed power of 30 B. H. P. on the Russian or Roumanian kerosene, which is the only fuel obtainable in Smyrna. The "M4" is one of Messrs. Thornycroft's latest productions, and is specially designed for arduous marine work, having specially large bearings, crankshaft and camshaft, with a very substantially designed crankcase. The consumption of fuel is about 0.9 pint per B. H. P. per hour.

The cylinders are of strong design with ample jackets having large doors for cleaning. The ignition is by high tension magneto, which it has been proved gives good results with kerosene fuel. The water circulation is maintained by a well made gear pump.

THORNYCROFT MOTOR BOAT BUTTERFLY.

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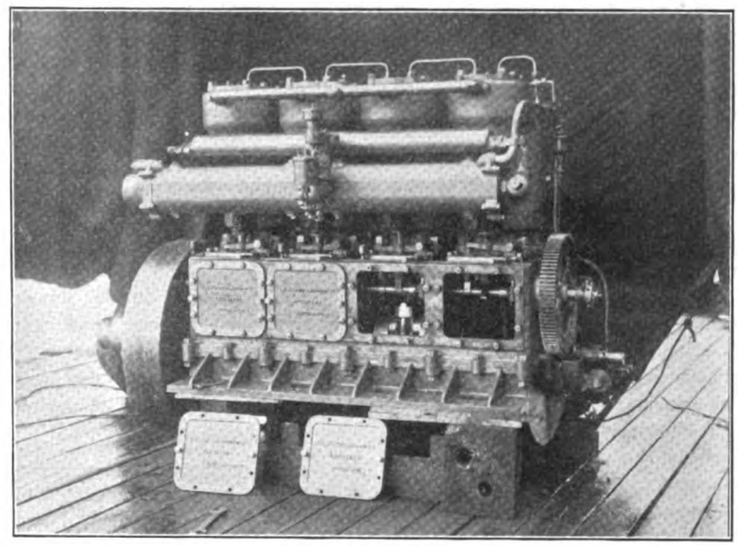
Forced lubrication is fitted with a simple relief valve by means of which the oil pressure can be regulated as desired, and as required by the condition of the bearings.

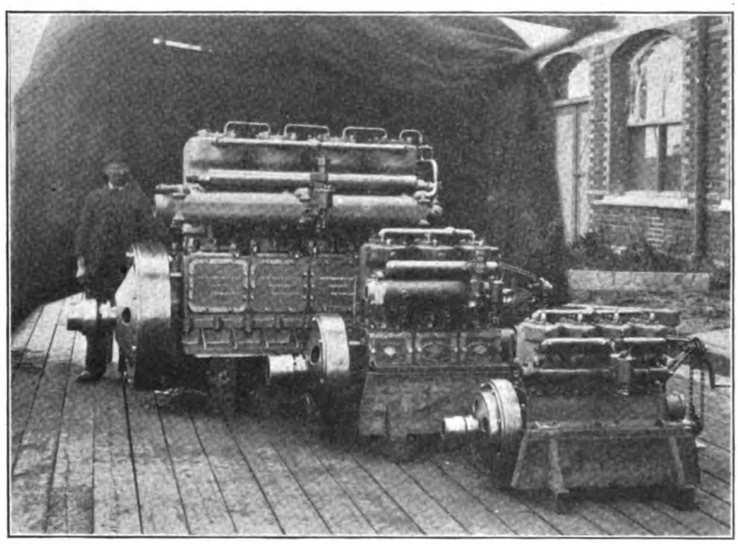
There is a roomy cabin forward with hinged porthole lights. The decorations are in white and gold with upholstery of scarlet. The seats are provided with swing edges to give increased width for use as sleeping berths, and there is an underline W. C. and lavatory. A cooking stove forms part of the equipment, and a 7 ft. collapsible canvas boat is carried as a dinghy.

The boat is fitted with lifting slings, spray hood, awning with deep sides as protection against the sun, and a hinged mast for emergency purposes which carries a balance lug sail.

Both wheel and tiller steering are provided.



100-H. P. 4-CYLINDER PARSONS MARINE MOTOR, 9-IN. BORE BY 12-IN. STROKE, FRONT VIEW.

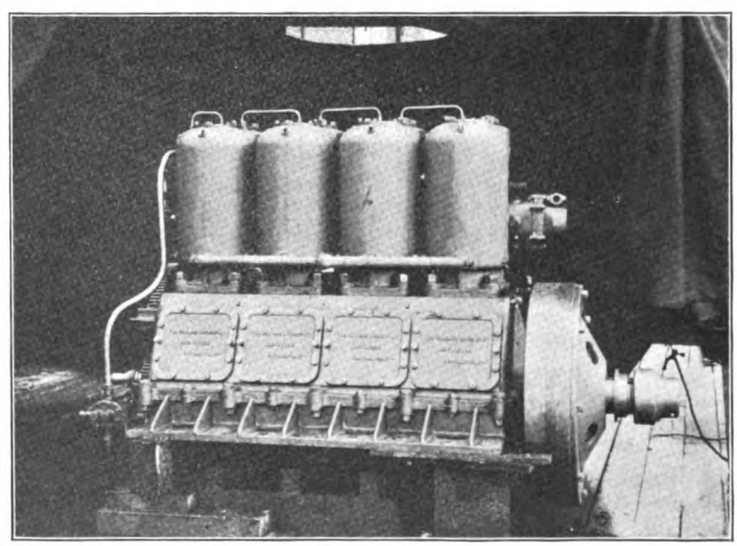


COMPARATIVE VIEWS OF SERIES OF PARSONS ENGINES, NAMELY 4½ C 6 IN. 6½ BY 8 IN. 9 BY 12 IN.

The guaranteed speed of the boat on Russian kerosene was 11 miles an hour, and about 11¼ miles was easily attained on the trial spins.

100 B. H. P. PARAFFINE MARINE MOTOR.

An interesting type of marine motor engine has just been placed on the market by the Parsons Marine Motor Co., Ltd., of Southampton, which both as regards design and workmanship is an excellent example of a high-powered internal-combustion motor, and which can be run as well on petrol as on paraffine. The engine develops 100 B. H. P. at 450 R. P. M. The four cylinders, each 9-in. bore by 12-in. stroke, are cast separately, and the general construction is clearly shown in our illustrations. The engine is usually started on petrol, but as soon as the cylinders and valves are warmed up, the petrol is turned off, and paraffine supplied by means of a single cock. It is quite practicable to start on paraffine alone, but the use of petrol makes the operation much handier. The peculiar feature about the Parsons engine is the design of the valves, and to these is due the complete success with which paraffine is used as fuel. As can be seen, the inlet valve is in the form of a large flanged tube, and itself constitutes the seating for the ordinary type of mushroom exhaust valve, the stem of which, with its guide, is situated in the center of the tube. Thus the hot exhaust gases passing down maintain the thin walls of the inlet valve at a high temperature. The incoming mix-



100-H. P. 4-CYLINDER PARSONS MARINE MOTOR 9-IN. BORE BY 12-IN. STROKE. BACK VIEW.

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ture of paraffine and air passes round the outside of the tubular valve, and is well heated before admission to the cylinder. As this final step in the vaporizing process takes place as nearly as possible within the cylinder itself, there is no chance for the paraffine to condense out again, as sometimes happens with the ordinary engine and independent paraffine carbureter. Moreover the great size of the inlet valve allows of a very free admission with extremely small lift.

Both inlet and exhaust valves are mechanically operated by separate cams, the former, in this size of engine, being worked through a hinged lever outside the crank case. For the suction stroke, both valves lift together, and they are both closed by the same spring. On the exhaust stroke only the exhaust valve is lifted, There is only one cam shaft, and for ease in starting sleeves upon the cam shaft can be slid along to engage with the exhaust cam rollers and give half compression. The design of the valves gives much more room round the cylinder studs than is the case when there are two springs, tappets, etc., and the simplicity of the whole arrangement is very commendable. There are already over 4,000 B. H. P. of these engines working, developing from 7 H. P. to 100 H. P., with a 36-in. fly wheel and clutch complete the weight of the engine is approximately 4,500 lb. The extreme length over clutch is 8 ft. 4 in. The fuel consumption is five gallons of paraffine per hour at full load and the exhaust is absolutely clear. Silence is assisted by water-jacketing the exhaust branch.

BRONZEWING.

Without doubt one of the largest and most sumptuously furnished private motor yachts at present in existence is the Bronzewing, owned by S. Hordern, a prominent yachtsman of Sydney. She is about 120 ft. in length, with a beam of 17 ft. 6 in. She was built in Sydney, of teak, under the supervision of the well-known architect of that city, Walter Reeks, and is intended for cruising on the inland waterways of the Australian continent, and also for journeys to the South Sea Islands, for which she is amply seaworthy.

Her machinery consists of three sets of 100 B. H. P. Thornycroft motors driving triple screws through reversing clutches. These motors are well known as the Thornycroft "D4" type, and develop their power at about 750 revolutions per minute. The cylinders, of which there are four on each engine, are 8 in. in diameter by 8 in. stroke, and are cast in pairs with large openings for inspection and cleaning. Lubrication is forced to all bearings by pumps. The fuel used is kerosene.

The motors are started by compressed air supplied by a Thornycroft 6-B. H. P. motor and compressor. This arrangement renders the whole plant as easily controllable as a steam engine combined with the inherent advantage of motors.

The provision of triple screws for yachts or other vessels which travel at cruising speed a good deal of their time permits of considerable economy, as the center engine, or if desired, the two wing engines, can be run at their full capacity, the other engine, or engines, standing idle. This, of course, ensures greater economy than if single or twin engines are employed throttled down to below their full capacity for cruising.

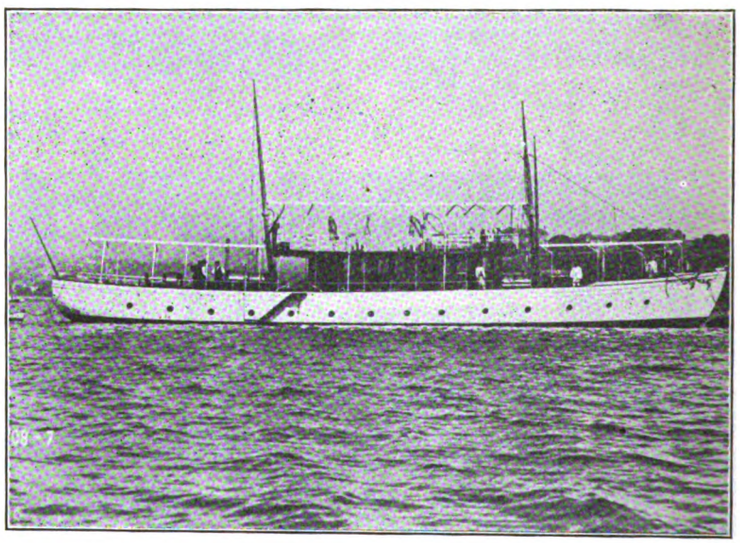
There is a very complete installation of electric light and electric fans, the dynamo being driven by a separate motor; the bilge pumps and winch are also electrically driven. The exhaust is water-cooled throughout the whole length, and is discharged at the stern above the water line.

We understand the yacht is being greatly admired by all yachtsmen at the Antipodes. The cabin accommodation is very complete, and exquisitely decorated and upholstered, and as will be seen by the illustration there is a promenade deck and provision for a canopy over the whole boat. The masts are hinged to permit of the low bridges being negotiated when cruising on the inland waterways.

It is worthy of note that both the architect, Walter Reeks, and Mr. Hordern, the owner, have had previous experience with Thornycroft marine motors, the latter with a 50 B. H. P. motor as auxiliary power in an earlier and smaller yacht of the same name as the present boat. It was no doubt the satisfaction experienced with these earlier motors that induced them to place the order for this much larger installation with Messrs. Thornycroft.

SOLACE TO BE HOSPITAL SHIP.

When the naval auxiliary Solace, now in the Pacific with supplies for Admiral Swinburne's Pacific fleet, shall have completed her duties there, she will start on a voyage for the New York navy yard, where the naval constructors will at once begin the work of transforming her into a modern hospital ship for service with the Atlantic fleet when it arrives back in home waters.



THORNYCROFT MOTOR BOAT BRONZEWING.

As is the case with the hospital ship Relief, at present on duty in the Pacific, the Solace will be commanded by a naval medical officer instead of by an officer of the line. The Solace is to be made capable of accommodating 200 sick sailors. On the hurricane deck forward will be an isolation ward for the treatment of contagious diseases. The quarters for line officers who are ill will be on the upper deck, while on the main deck will be two large hospital wards. The operating room will be on the upper deck. An effort will be made to do the work on the Solace in 70 days.

The collier Prometheus will be launched at the Mare Island navy yard on Dec. 5.

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Recent Improvements in Lifting Magnets.

The first commercial lifting magnet was placed in service in this country about 13 years ago. This magnet was designed by S. T. Wellman for handling plates and slabs and proved fairly satisfactory for such service. The design was later refined and improved upon by E. B. Clark, then electrical engineer for the South Works of the Illinois Steel Co.

The manufacture of lifting magnets of both the Wellman and Clark types was taken up by the Electric Controller & Mfg. Co. (then the Electric Controller & Supply Co.) more than two years ago. A special magnet testing machine was designed and installed and much valuable data bearing on the design of lifting magnets was secured.

Many magnets of the Clark type have been manufactured and sold and have given excellent results in the handling of smooth homogeneous material such as plates, blooms and slabs. These magnets, however, were useless for handling rough and detached material such as pig iron, crop ends and scrap. A magnet which would readily lift a steel ingot weighing 10,000 pounds would not lift a single pig of iron weighing 100 pounds.

Many attempts were made to perfect a magnet for handling pig iron and scrap since obviously the large amounts of such raw material handled by tedious hand methods at all steel and iron works and foundries offered a tremendous field for the saving of labor, providing a practical lifting magnet could be developed for the purpose.

Perhaps the first experiments in this direction which gave promise of commercial results were made at the West Seneca plant of the Lackawanna Steel Co., under the direction of E. D. Edmonson and L. R. Palmer, a lifting magnet being constructed which actually lifted pig iron, though in rather small quantity, taking into consideration the weight of the magnet and its current consumption.

The first commercially successful magnet for handling pig iron, scrap and miscellaneous magnetic material was placed on the market by the Electric Controller & Mfg. Co. in March, 1905. This magnet was built in two sizes, commercially known as No. 1 and No. 2 Type S magnets. Over 150 of these magnets have since been placed in service and at a conservative estimate saved to the iron and steel trade of this country at least half a million dollars in the cost of handling material within the past year. This type of magnet has also been introduced in Germany and England.

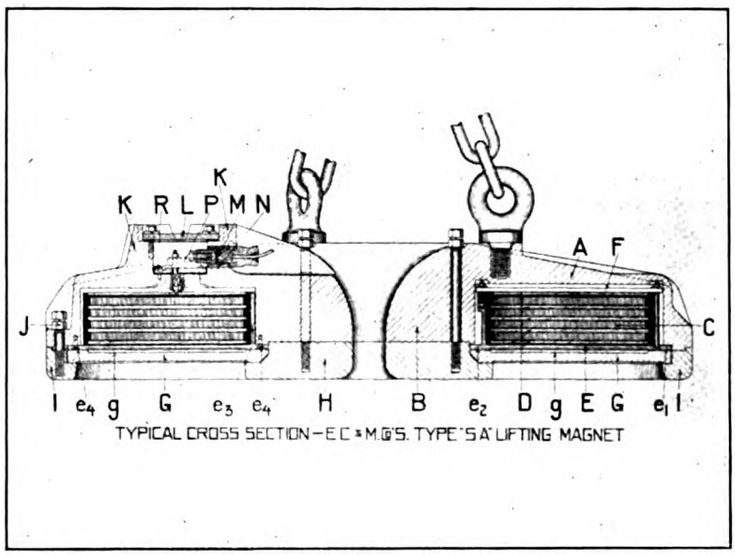
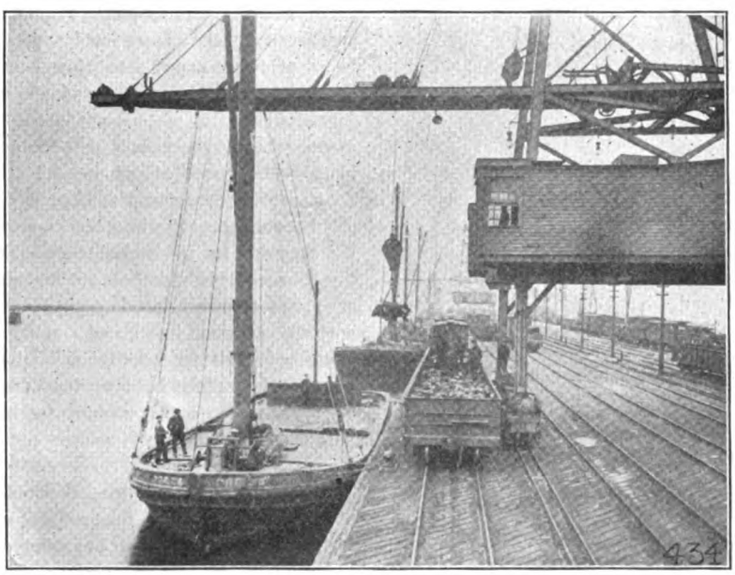


FIG. 1.

In view of these facts there can be no doubt that Type S magnets as manufactured by the Electric Controller & Mfg. Co. have become satisfactory and reliable tools—more dependable in fact than the cranes which carry them. This company, however, has not been content to rest upon the satisfactory results thus far obtained with its "Type S" magnets, but has been constantly at work on improvements both in the direction of dependability and in increased efficiency in the handling of material.

Unquestionably a successful lifting magnet must withstand in service more severe abuse and rough handling than any other type of electrical apparatus. In operation it is suspended from the hook of a crane (frequently not equipped with a lowering brake) and may be dropped at high speed upon the material to be lifted, which may be comparable almost to dropping the magnet from a second story window. In service it will be swung against cars, charging boxes, piles of pig iron, etc., and must be capable of withstanding the



NO. 2 TYPE "S" MAGNET TRANSFERRING CARLOAD OF TIE PLATES TO LIGHTER AT THE DOCKS OF THE PENNSYLVANIA RAILROAD CO., GREENVILLE, N. J.

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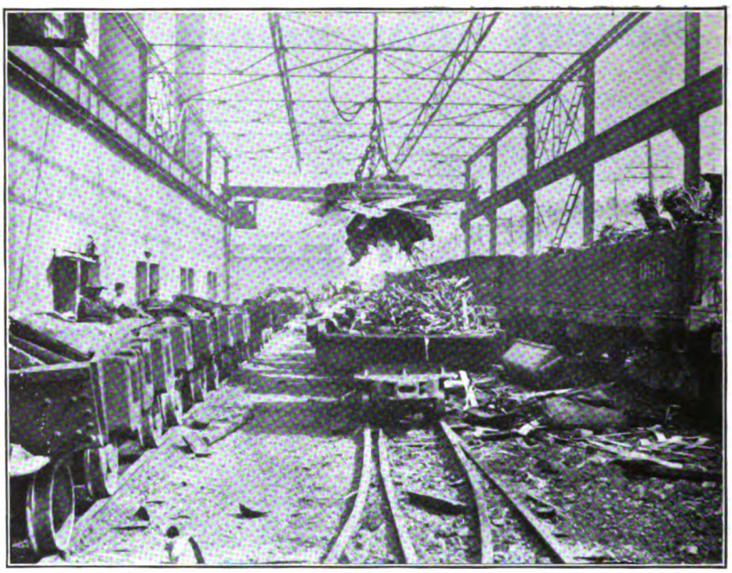
blows and shocks which result. It must operate under all weather conditions, day or night, irrespective of rain or snow, and its insulation must withstand a voltage much higher than line voltage due to the inductive kick which occurs when the circuit of the magnet is opened. Its winding must not be injured by the large amount of heat which is necessarily generated within it, but preferably also should not be damaged by external heat when the magnet is called upon to handle hot material.

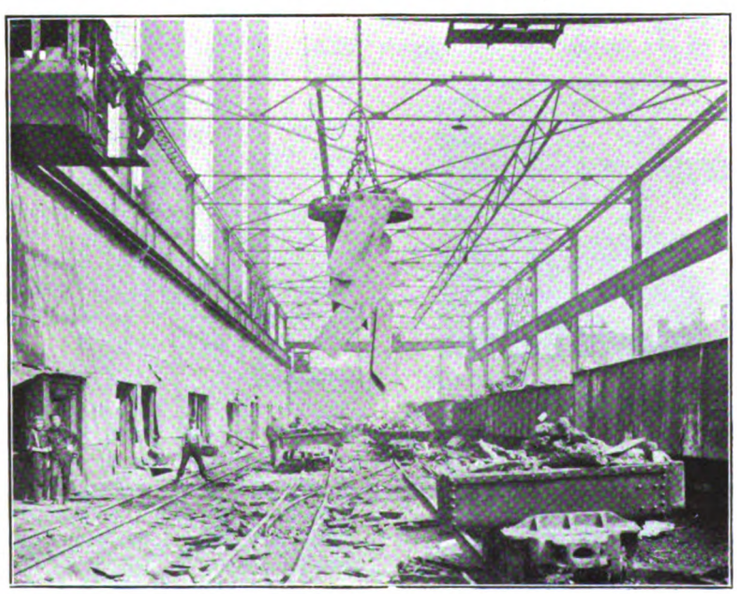
Among the accompanying cuts, Fig. 1 is a typical cross-section of a Type S-A magnet and shows the arrangement of parts which by experience has been found to meet the severe and exacting requirements of service.

In Fig. 1, A is the body or frame work of the magnet which is an annular casting of special electrical steel heavily ribbed on both its upper and outer surfaces. The ribs serve to add largely to the surface available for dissipating heat and are so disposed as to stiffen the magnet case mechanically and at the same time add to the cross-section of the magnetic circuit.

B is the core of the magnet which is surrounded by the winding C. This winding is composed of a series of coils each wound with a conductor in the form of a copper ribbon or strap, the turns of which are insulated with asbestos ribbon. Neighboring coils are mechanically separated and electrically insulated by non-combustible insulating discs D. The coils are wound upon a heavy brass form E which resembles a spool with one head removed. This form serves to support the coils during the process of winding and insures coils of uniform and perfect shape since there is no danger of springing or otherwise distorting the winding. After the last or uppermost coil is wound and the outer disc of insulation in place, the entire winding is rigidly clamped to the form by means of radial straps F, which are bolted and locked in place, thus making the winding and the broad form which carries it a rigid unit. The completed winding is then dried in a steam heated chamber under a vacuum and when the initial drying process is completed the winding is impregnated with a plastic insulating compound—first under the influence of a vacuum and then under air pressure, and finally is again dried under a vacuum. This results in a winding not only fireproof—not a particle of combustible material being used in its make-up—but what is of still greater importance, the winding is thoroughly waterproofed. The completed winding is then placed in the magnet case.



NO. 6 TYPE S-A MAGNET SHEET SCRAP, WEIGHT 1,200 LBS. AT CARNEGIE STEEL CO., HOMESTEAD, PA.



NO. 6 TYPE S-A MAGNET LIFTING PLATE SCRAP WEIGHING 900 LBS. AT CARNEGIE STEEL PLANT, HOMESTEAD, PA.

It will be noted that the form E is provided with an outer flange e1, and an inner flange e2 in addition to the central upwardly-extending flange e3 which centrally supports the winding. The inner and outer flanges are carefully finished and engage with finished surfaces on the inner and outer pole faces of the magnet case, thus completely sealing the lower face of the winding chamber, a water-tight joint being insured by clamping the flanges in place with screws e4, e4, spaced 4 inches apart entirely around the flanges e1 and e2. Since the winding is clamped to the form E by the radial clamps F and the Form E is clamped in the magnet case by screws placed 4 inches apart entirely around its inner and outer edges, it will be readily seen that the winding is rigidly held against displacement—a result which cannot be reliably obtained by means of wedges or similar expedients.

With the winding thus assembled in the magnet case the lower face of the coil form E is covered by a heavy annular plate of non-magnetic manganese

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NO. 2 TYPE "S" MAGNET UNLOADING CAR OF BAR IRON AT THE PENNSYLVANIA RAILROAD CO.'S DOCKS, GREENVILLE, N. J.

steel G, which in turn is held in place by pole shoes H and I bolted respectively to the inner and outer poles of the magnet case. Both of the pole shoes are provided with shoulders which protect the clamping bolts from shearing strains. The heads of the outer clamping bolts J are located between adjacent ribs on the outer surface of the magnet case where they are protected from abrasion.

The wearing qualities of manganese steel are well known, this material being used for frog and switch points on modernly equipped railways, both electric and steam.

The Electric Controller & Mfg. Co. early investigated the fitness of this material for use in wearing plates for lifting magnets and about two years ago a quality of manganese steel was found which answered the purpose admirably, it being both hard and tough and at the same time practically non-magnetic.

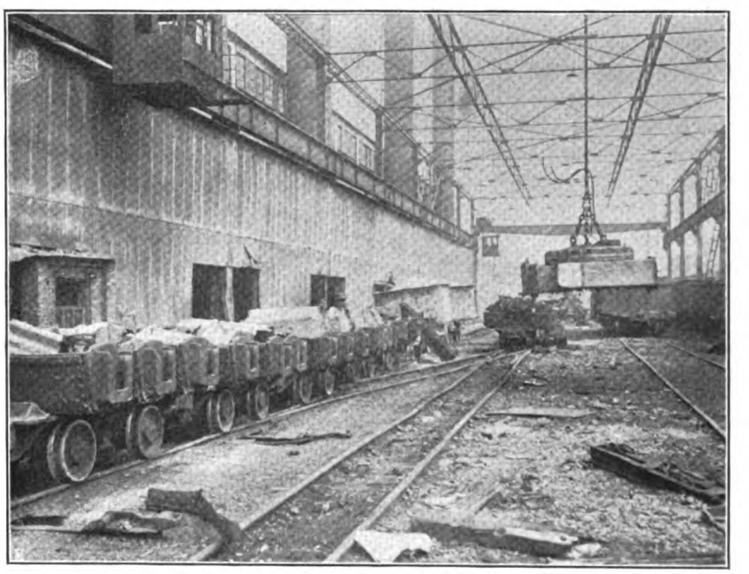
In the cross-sectional view it will be noted that the manganese steel plate G carries raised shoulders around its inner and outer peripheries by means of which the plate is made to seat against the magnet poles and an air space or cushion is left under the winding at g. This results in the shocks taken by the outer plate G being transmitted directly to the magnet frame instead of being taken by the winding as would necessarily be the case if only a single bottom plate were used.

The pole shoes are so disposed with respect to the outer plate G that none ofthe clamping surfaces can become battered over, and therefore the plate G may always be readily renewed.

It will be seen that the entire lower or wearing face of the magnet is renewable and that these renewals can be readily effected in the field, there being no necessity of in any way exposing or disturbing the winding or breaking the water-tight joint between the coil form E and the frame of the magnet.

The arrangement of terminals also deserves attention, since no matter how good the design in other respects, if the terminal construction be weak, trouble is certain to result from this cause.

In Type S-A magnets the terminal cavity is surrounded by raised walls K. K. cast integral with the magnet case and of such thickness as to be as strong as the magnet case itself. The terminal cavity is closed at the top with a heavy steel cover L, which seats against a gasket to form a water-tight joint and is firmly bolted in place, the heads of the bolts being protected from abrasion by the walls of the terminal cavity. All of the terminal parts are thus enclosed in a water-proof box of steel. The terminals themselves, as in the earlier Type S magnets, are of the plug type which permits of quick attachment and detachment of the service wires. Numerous improvements however, have been made in the details of construction. The female members M of the terminal are enclosed in an insulating tube so that a ground or short circuit cannot result even if the service wires are left hanging from the crane with current on. The insulating tubes are each encased in a steel tube to prevent abrasion of the insulation and these steel tubes fit closely in babbitted openings N in the side of the terminal chamber. The male members P of the plug connectors are mounted upon a heavy plate R of fireproof insulating material which closes the entrance to the winding chamber and is seated upon a gasket to effect a watertight joint. The plugs proper are separable from the terminals by removing the nuts which hold them in place. The plugs and also the plate R may therefore be removed without throwing any strain on the connections to the winding, the connections consisting of loops of very flexible copper ribbon, these loops being stowed away in the box-like ends of the terminal studs. This construction permits of great flexibility and at the same time makes it impossible for the



NO. 6 TYPE S-A MAGNET LIFTING THREE INGOTS, WEIGHT 16,000 LBS. AT CARNEGIE STEEL PLANT, HOMESTEAD, PA.

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flexible leads which connect to the two ends of the magnet winding to come into accidental contact. These features of construction indicate how carefully the design of Type S-A magnets has been thought out and worked out from a mechanical and electrical standpoint.

In addition to these structural feaures, the Electric Controller & Mfg. Co. have incorporated in the design of Type S-A magnets, the results of long experience and careful study of the best proportions for securing maximum efficiency in handling material.

By maximum efficiency is meant the ability to handle the largest amount of material in a given time with minimum total consumption of current. In this respect the results obtained with Type S-A magnets far surpass any results which have been obtained in the past. As an instance, the No. 4 Type S-A magnet, 40 in. in diameter, lifts substantially as much as older forms of magnets of 50 in. in diameter with substantially the same current consumption, but weighs 2,000 pounds less. Comparing the performance of the two magnets on a five-ton crane having a 25 H. P. hoist motor, with equal lifts, the No. 4 S-A magnet has the advantage of 2,000 pounds in total load to be lifted or 20 per cent of the total hoisting capacity of the crane. This will mean a saving in current consumption of 20 amperes on the part of the hoist motor, and by virtue of this lower current consumption and lighter load the hoisting speed will be higher and the amount of material handled in a given time will be materially increased.

Proportionable increases in efficiency are shown by the No. 5 and No. 6 Type S-A magnets, the No. 6 magnet being without question the most powerful commercial lifting magnet which has ever been constructed.

THE GYROSCOPE AND SEASICKNESS.

Dr. Schlick's gyroscopic apparatus having been fully described in the MARINE REVIEW as an effective means of preventing seasickness by reducing to a minimum the roll of a vessel in rough waters, it will interest our readers to learn that Messrs. Swan Hunter & Wigham Richardson, ship builders, have just carried out some important tests, which have given fresh proof of the power and suitability of this apparatus for the work for which it is designed. The apparatus has been fitted on board the passenger steamer Lochiel, which runs between Oban, Tiree and Bunessan, in Scottish waters, and the trials so far made have been attended with most satisfactory results. When the gyroscope was not in use, the vessel rolled to angles of 16° on each side—that is to say, the total angle of roll was no less than 32°. When, however, the apparatus was put into action, the rolling decreased to a total angle of 2° to 4°, an amount which is hardly perceptible to a passenger. The gyroscope on the Lochiel is driven electrically, and requires little attention. The design has been simplified, and the machine, which is now compact, takes up but very little space in the steamer. As soon as the advantage of the apparatus becomes better known to the traveling public, the gyroscope will be a necessity on all boats carrying passengers, especially for short voyages, as by its means seasickness is greatly reduced, if not entirely prevented.

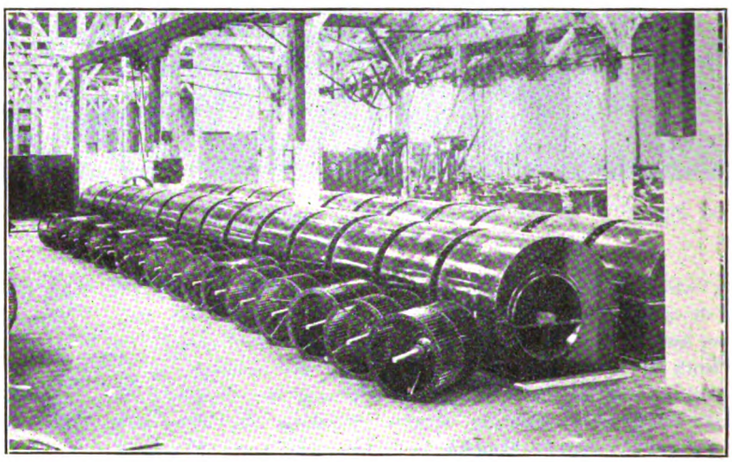
FORCED DRAFT FANS FOR BATTLESHIPS DELAWARE AND NORTH DAKOTA.

The accompanying photograph shows 28 motor-driven fans recently constructed for installation on the United States battleships Delaware and North Dakota by the Sirocco Engineering Co., of Troy, N. Y. Fourteen of these fans, each of 27-in. diameter and 24,000 cu. ft. per minute capacity, will be installed on each of the ships. They are driven by motors constructed by the General Electric Co., of Schenectady, N. Y.

This is the first large order of Sirocco fans filled by the makers for the United States navy, though this fan is in general use in the navies of the principal European powers and vessels of the trans-Atlantic steamship companies. Sirocco fans are now under construction for the United States torpedoboat destroyers Nos. 17, 18 and 19, on which the plenum system of draft will be used.

NORTH GERMAN LLOYD FLEET.

The extensive ship building program which was inaugurated nearly a score of years ago by the North German Lloyd Steamship line, has reached its consummation in the recent launching of its two great liners, the George Washington and the Berlin.



SIROCCO FORCED DRAFT FANS FOR THE BATTLESHIPS DELAWARE AND NORTH DAKOTA.

This undertaking has involved the expenditure of more than $50,000,000 and has resulted in the complete rehabilitation of the North German Lloyd fleet.

"This reorganization of its fleet was begun when George Plate and Dr. Wiegand assumed control of the affairs of the North German Lloyd and the building plan was the result of investigations made to meet the increasing demands of the traveling public for additional comforts on board ship; the enormous advance made in ship building and the ever increasing competition in shipping, together with the extension of trans-oceanic commerce and transportation," said Gustave H. Schwab, representative of the North German Lloyd at New York.

"While the present building program has been completed it by no means follows that the North German Lloyd will not build other steamships. Investigations and inquiries are constantly being made into the results obtained by other lines.

"The first of the great express steamships built under the new program was the Kaiser Wilhelm der Grosse, for years the fastest on the

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ocean. Others which have followed are the Kronprinzessin Cecilie, Kaiser Wilhelm II, Kronprinz Wilhelm, Prinz Friedrich Wilhelm, and lastly the Berlin and George Washington. In addition to these, a number of smaller ships have been built, all of which are now engaged in the various services of the Lloyd.

"Except for an infinitesimal amount, this great sum was expended entirely in the ship yards of Germany.

"The latest steamship, the George Washington, will not be as fast as the four express steamships of the company, the Kronprinzessin Cecilie, Kaiser Wilhelm II, Kronprinz Wilhelm and Kaiser Wilhelm der Grosse. The Berlin is intended for the Mediterranean and will be one of the largest steamships in that service."

A comparison of the dimensions of the three largest and newest steamships of the North German Lloyd will prove interesting.

	George Washington.	Kron-prinzessin Cecilie.	Berlin.
Length	722	705	612
Beam	78	72	69
Depth	54	52	50
Speed	18.50	23.50	17.50
Draught	33	30	31.08
Displacement	36,000	27,000	28,000
Net registered tonnage.	28,000	20,000	19,200
Passengers:—			
First class	520	742	230
Second class	377	327	300
Third class	614	...	...
Steerage	1,420	740	2,700
Total	2,941	1,809	3,230
Crew	525	650	420

On the George Washington a new class has been created, to be known as the third class, and is intended for those passengers who find the cost of second cabin passage too high, yet who do not wish to travel in the steerage. Passengers in the third class will have their own dining room, smoking and lounging rooms and ample deck space.

BATTLESHIP BIDS REJECTED.

All bids for the construction of the hull and machinery for the battleship Florida have been rejected by the navy yard and the vessel will be built entirely at the New York navy yard.

As the board of construction has recommended that the Florida be equipped with turbine engines of the Parsons type, Acting Secretary of the Navy Newberry has entered into negotiations with the owners of the shop rights of both the Parsons and Curtis types of turbines for authority to build the Florida's machinery at the New York yard. The recommendation of this particular type of machinery was based on the fact that the battleship Utah, a sister ship of the Florida, which is to be built by the New York Ship Building Co., at Camden, N. J., is to have Parsons turbines, and it is the desire of the board that the two ships be similar in every detail.

NO SHORE LEAVE AT MANILA.

Rear Admiral Sperry, in a recent letter to Governor General Smith, at Manila, states that it has been decided not to grant the men of the battleship fleet shore leave while the vessels are at Manila, owing to the prevalence of cholera in that city.

In addition to the danger to the health of the men of the fleet, it is pointed out that there is danger of getting into difficulties with regard to quarantine in the Mediterranean.

Governor Smith has communicated with the government at Washington and it is expected that President Roosevelt will make a decision within a few days which will settle the matter definitely.

The attitude of Rear Admiral Sperry is much resented in Manila, the more so as Rear Admiral Harber, commanding the third division of the Pacific fleet, has removed any such restriction from his men, who are being enthusiastically received.

ARMY AND NAVY RETIREMENTS.

The number of retirements of both army and navy officers during 1909 will be an unusually large one, owing to the age limit affecting a great many well known officers. In all 38, representing every branch of the united services, will go on the retired list in the next 12 months, of which number 19 are in the navy, 14 in the army, four in the revenue cutter service and one in the marine corps.

Amongst the naval officers to be affected are 11 rear admirals, as follows: Goodrich, Sperry, Swinburne, Hemphill, Pendleton, Moore, Barnette, McLean, Leutze, Taussig, and Ingersoll. Admiral Goodrich who retires in January, will be the first to go, and Admiral Ingersoll, who retires in December, 1909, will be the last. Admiral Swinburne retires in August, and Admiral Sperry in September. The retirement of Admiral Sperry brings up the question as to who will be the next commander of the Atlantic fleet, and the general belief is that when Admiral Sperry hauls down his flag, that of Rear Admiral "Dick" Wainwright, one of his division commanders, will go up.

Other naval officers who will retire are Medical Director William S. Dixon, Pay Director James A. Ring, Chief Carpenter Edward H. Hay, Medical Director Thomas H. Streets, Medical Director Abel F. Price, and Capts. Nathan E. Niles and D. V. Stuart.

REPORT OF BUREAU OF YARDS AND DOCKS.

Rear Admiral R. C. Holliday, chief of the bureau of yards and docks, in his annual report recently submitted to the navy department, dwells upon the pressing need for more dry docks, as well as for barracks at the Mare Island and Philadelphia yards capable of caring for large numbers of men.

The total amount that congress will be asked to appropriate for work in the navy yards for the year is $11,341,730. Last year the bureau expended $5,903,350, while congress last May gave $4,659,400 for the continuation of work until next June.

The amount needed for the League Island yard is $721,500 and for the New York navy yard $693,830. The principal item for New York is $300,000 for continuation of work on the granite and concrete dry dock. Other items are $116,000 for the central lighting plant, $130,000 for fireproofing and $76,330 for dredging. Chief Holliday wants a dry dock at Guantanamo, Cuba, to cost $2,250,000, and one at Pearl Harbor, Hawaii, to cost $2,000,000.

THE BRISTOL CHANNEL DRY DOCK COMBINE.

The agreement with regard to the amalgamation of the Bute and the Channel dry dock companies in the Bristol channel has not yet been signed (Wednesday, Nov. 18), but it is authoritatively stated that the main terms arrived at are as follows: (1) The acquisition of the ordinary shares in the Bute Dock Co. at the rate of £7 per £10 share; and (2) the creation of a joint board, composed of the present directorate of the Channel and the Bute companies. The two undertakings will both retain their present titles and separate identities, but the identity of the Bute company will in future be a purely nominal one. The Mercantile Pontoon, owned by the Bute company, is also taken over, and the three undertakings, it is understood, will fall under the general administrative control of William Jones, the manager of the Channel company. The fusion creates one of the most extensive and powerful ship repairing combines in the United Kingdom.

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ATLANTIC DEEPER WATERWAYS ASSOCIATION MEETING.

At the first annual convention of the Atlantic Deeper Waterways Association, held in Baltimore, Md., beginning Nov. 17, more than 300 delegates were present.

The object of this association is to promote the construction as a national enterprise of a chain of canals connecting natural and protected waterways along the Atlantic coast, thereby forming a continuous inland waterway from Boston to Key West.

The delegates were all enthusiastically of the opinion that the project is not only feasible but that it is a necessary measure for solving the transportation problems which now confront the country at large. The availability of this waterway as a national defense in time of war was also pointed out.

Many messages expressing wishes for success were received, the senders including President Roosevelt, President-elect W. H. Taft and Judge Gray, of Delaware.

President J. Hampton Moore, of Philadelphia, in his address told what had been accomplished for the movement during the year since the formation of the association at Philadelphia. He urged a campaign of agitation and education. One feature of his address was an account of his trip abroad last summer for the purpose of inspecting the harbors and waterway improvements of the European countries. The trip, he said, demonstrated clearly that while the United States has been marvelously prosperous, it has been shamefully prodigal in the matter of its wealth and strangely neglectful of opportunities for retaining it.

Edward Parrish, assistant United States engineer at the Newport office, read a paper on the relation of Rhode Island waterways to the inland coastal canal. He said in part:

"The special points of danger to navigation on the southern New England coast are Point Judith and Cape Cod. Two methods have been proposed for the avoidance of the latter, namely, a canal from Fall river to Boston via the Taunton river, Brockton and Weymouth Fore river, and the so-called Cape Cod canal from Buzzards Bay into Cape Cod Bay. The elimination of Point Judith as one of these dangers has not heretofore been proposed; but as one of the prime considerations of a coastal canal must be to afford a safe waterway, free from the dangers of ocean navigation, a canal to pass through Rhode Island inside this dangerous point must form a link in the chain of artificial waterways along the Atlantic coast of the highest importance.

"The stretch of ocean navigation from Race Rock, at the eastern end of Long Island, to the mouth of Buzzards Bay, through which the Cape Cod canal must be reached, about 60 miles in length, is perhaps the scene of more marine disasters accompanied by serious loss of life and property than any like distance along the Atlantic coast, save that from Provincetown to Nantucket Sound. And this condition pertains not by reason of more severe storms and heavier fogs than elsewhere, although there is an abundance of both, but largely from the enormous traffic passing. It has been said that with the exception of the Detroit river and the English channel there is a greater number of vessels passing through the Vineyard and Nantucket Sounds than through any marine thoroughfare in the world. Be that as it may, 22,682 vessels passed Point Judith in daylight during the year 1907, and it is estimated that 55 per cent additional passed at night, making a reasonable estimate for the total of the year of 35,154 vessels. This traffic is, in a way, congested, for in thick and foggy weather every vessel bound for Narragansett Bay is obliged to take her departure from Race Rock Light and run her prescribed course for a certain number of hours and minutes and strike the Point Judith whistling buoy, or she is in imminent danger, and the vessel bound out of the bay is obliged to take the same line from the whistling buoy for Race Rock. In the same way vessels bound to and from points east of Narragansett bay are compelled to follow prescribed courses, with sailing vessels forming about 28 per cent of the fleet, beating across the course in adverse winds. In addition to the vessels coming out of Long Island Sound, there are those from southern ports coming in by Montauk Point, and to the eastward of Block Island, converging on the Point Judith whistling buoy and the Vineyard Sound lightship, increasing the hazard to the navigation of these waters.

"Relief from the risks of navigating this ocean reach may be obtained by a Rhode Island canal. By leaving the usual course in Long Island Sound at about New London and entering Fishers Island Sound, passing Stonington Harbor into Little Narragansett Bay; the sea level canal proper, beginning back of Watch Hill, R. I., and thence eastward along the southern shore of that state, through a series of large ponds, lying back of the beach, to Point Judith Pond, thence northerly through that pond to its head between Narragansett Pier and Wakefield; thence through a short divide with an elevation of between 20 and 40 ft. into the valley of the Pettaquamscott river, thence northward through that river to its head waters some six miles north of Narragansett Pier, to another divide of about the same height as that referred to above; thence northeasterly through this divide to the vicinity of Bissels Cove in the protected waters of Narragansett Bay, some two or three miles above Dutch Island Harbor. A distance of 31½ miles of canal, 24½ miles of which are now flowed by tide water. From the eastern end of this canal there is a safe and free navigation through the bay and Providence river to Providence and Pawtucket and through Narragansett and Mount Hope Bays and Taunton river to Fall river and Taunton; and when it may be built through a canal from Taunton river to Boston harbor to Boston. Then will the idea of a protected waterway between Boston and the south be a reality. The Rhode Island canal would in all probability be provided with an outlet to Point Judith harbor, where vessels bound for New Bedford and the Vineyard and Nantucket Sounds could await favorable weather for the ocean trip which must be made to reach these points."

Congressman Small traced the steps necessary to be taken to secure congressional aid for the improvement of any waterway, and explained the resolutions already before congress providing for an examination and survey of a continuous water route from Boston to Beaufort Inlet, South Carolina, which he described.

Rear Admiral Melville was of the opinion that for commerce alone a channel of say 16 ft. depth would provide adequately for vessels of 1,500 to 2,000 tons capacity, which, he said, would probably be the average size of vessels engaged in such a traffic by a sheltered waterway from Massachusetts Bay to the sounds of North Carolina, or even to Florida. To make this of real value, however, he declared, the depth must be adequate to permit of the passage of battleships which means a present depth of about 30 ft., and possibly at a later date 35 ft. At present 30 ft. would take care of our vessels of deepest draft.

Continuing, Rear Admiral Melville said: "Possibly it is not necessary to mention it, but I do not want you for a moment to think that the idea of providing this international route is to make of the sand dunes of our

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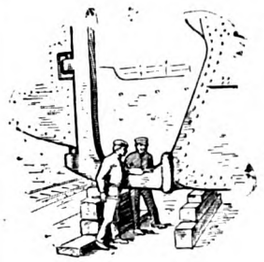

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Atlantic coast a refuge behind which our fleet is to hide. No one believes more firmly than I that the proper battle line for any navy is the coast line of the enemy, but it is to enable us to get the maximum advantage of our fleet that this scheme is advocated.

"So important do I feel is the movement you have started for the improvement of these international waterways," he said, "that much as I desire to see our navy increased to its proper rank, I feel we might, with advantage, reduce our naval building program in order to push this work, if that were necessary. I cannot believe, however, that our representatives in congress can fail to appreciate the importance of this matter when it is properly presented to them."

ITEMS OF GENERAL INTEREST.

At the request of the Cambridge Trust Co., Wm. I. Schaffer, of Chester, Pa., has been appointed receiver for Roach's ship yard. Since the death of John B. Roach the company has been without an executive head. The plant is a famous old ship yard, John Roach having built there many famous vessels.

The prison ship Martyr's monument was dedicated at Brooklyn last week. This monument was designed by the late Standford White and is intended to perpetuate the memory of those who were imprisoned in ships lying in the East river by the British during the American Revolution. President-elect Taft, Secretary of War Wright and Gov. Hughes made addresses.

Charles M. Schwab, president of the Bethlehem Steel Corporation, has purchased the dry dock of the San Francisco Dry Dock Co., located at Hunter's Point, San Francisco Bay. A dispatch from San Francisco announces that the plant of the Union Iron Works is to be removed to Hunter's Point. It is understood that the transfer was made on the basis of $125 a share.

The Cunard Line has decided to use the Canada graving dock at Liverpool for docking the Mauretania. She will enter the dock astern first so as to bring her port side into a favorable position for the 50-ton traveling crane. This decision is a great disappointment to Cammell, Laird & Co., as it was the original intention to dock the Mauretania in their new graving dock at Birkenhead.

The steamer George Washington which was launched at Stettin last week for the North German Lloyd had the distinction of being christened by the American ambassador, David J. Hill. The ambassador made a brief speech before he broke the customary bottle of champagne over the vessel's bow. The George Washington is 722 ft. long, 78 ft. beam and 80 ft. deep measured from the awning deck. She will have accommodations for 2,941 passengers in addition to a crew of 525 men. Her speed will be moderate, about 18.5 knots.

The new twin-screw steamer America was launched at the Muggiano ship yards at Spezia, Italy, recently for the La Veloce line. She is of 12,000 tons displacement and is 500 ft. in length. The America has been specially constructed to meet the demands of the company's passenger traffic between Genoa, Naples and New York, and she will accommodate 100 first class, 70 second class and about 2,000 steerage passengers.

The schooner Lulie L. Pollard, bound to New York from Fernandina, Fla., with a cargo of lumber, was burned at sea last week. Her crew was rescued by the steamer Admiral Schley, which came upon the burning schooner about 45 minutes after the fire started. The Lulie M. Pollard was a four-masted schooner of 471 tons. She was built at Milton, Del., in 1891, and was owned by Stetson & Winsmore, of Philadelphia, Pa.

A petition is now in circulation among shipping interests at Seattle in which the city is urged to take some action toward the establishment of a municipal dry dock to be operated on the same plan as the one at Portland, Ore., known as the Port of Portland Dry Dock. This would give the small builders and those engaged in repair work an opportunity to make bids for repairs to vessels on the Sound, which has hitherto been denied them owing to the private ownership of docks in that vicinity. It is the design of the petitioners to have the dock located on the harbor front in the vicinity of Smith's Cove.

Charles M. Schwab, head of the Bethlehem Steel Corporation and organizer of a combine of several San Francisco ship building plants, said in an address before the Rotary Club, a newly formed promotion organization of that city, that the cost of labor in that city was twice that of any city in the east, not so much because of the wages paid but because of the amount and quality of the work performed. He predicted that not until the labor situation had materially changed would San Francisco assume the position rightly due her in the commerlial world and eastern capitalists be encouraged to make investments in her industries. Mr. Schwab also touched upon the rulings of the interstate commerce commission in regard to the publication of rates by transcontinental railroads by which means it is claimed that the export business of the Pacific coast will in the future be monopolized by vessels of foreign register.

Commander Ross, of the revenue cutter service, recently conducted a party of steamship men and members of the New York maritime exchange over the new derelict destroyer Seneca, which was lying at anchor in New York harbor.

The White Star line has been negotiating for some time for the construction of an immense dry dock at Southampton, England, and arrangements were finally concluded on Nov. 10 which assure the building of the dock. It is to be capable of accommodating the new leviathans at any stage of the tide. The London & Southwestern railway, owner of the docks at that port, is to apply to the next session of parliament for a charter to construct the new dry dock. The White Star's new giant liners, Olympic and Titanic, are to be 1,000 ft. long.

Premier Asquith has recently set forth in the house of commons what is meant by the British two-power standard of naval strength. Hitherto the premier has been non-committal concerning this policy which the government is pledged to maintain. Briefly it is conceded to mean that a preponderance of 10 per cent over the combined strength in capital ships of the two next strongest naval powers shall at all times be maintained. This statement is taken as a confirmation of the report that at least six and possibly seven additional warships of the Dreadnought type are to be provided for in the next naval estimates.

The Central Vermont Transportation Co. has recently been organized at Portland, Me., for the purpose of conducting a steamboat service between New London, Conn., and New York, in connection with the Central Vermont railroad. The authorized capital is $200,000 and it is understood that the company will purchase steamers at once. The Central Vermont railroad is a branch of the Grand Trunk system, which thus secures direct steamboat connections with New York in the same manner as does the New York, New Haven & Hartford railroad with the steamers Mohawk and Mohegan.

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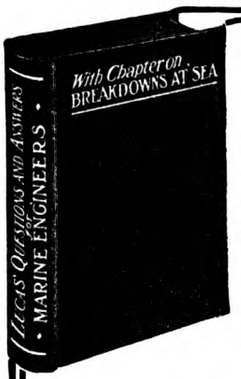

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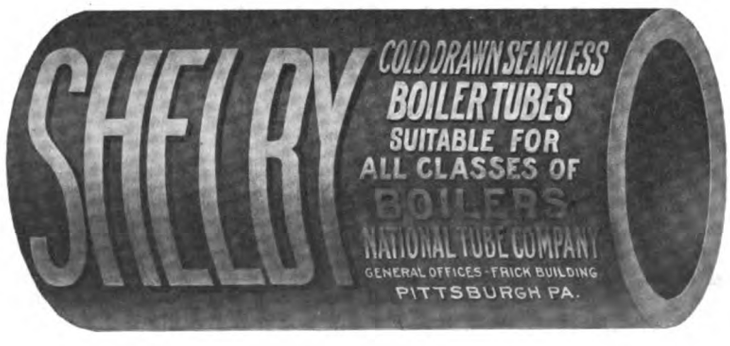

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